UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

October 18, 2002

Mr. Fritz Rennebaum
Bureau of Land Management
Upper Columbia-Salmon/Clearwater District
1808 North Third Street
Coeur D'Alene, Idaho 83814-3407

RE: Endangered Species Act and Essential Fish Habitat Consultations: Biological Assessment for the Bureau of Land Management Salmon and Challis Field Offices' 2002 Noxious Weed Control Program (One project)

Dear Mr. Rennebaum:

Enclosed is the biological opinion prepared by the National Marine Fisheries Service (NOAA Fisheries) on the Biological Assessment for the Bureau of Land Management Salmon and Challis Field Offices' 2002 Noxious Weed Control Program. The enclosed document represents NOAA Fisheries' biological opinion on the effects of the proposed action on listed species and designated critical habitat in accordance with section 7 of the Endangered Species Act (ESA) of 1973 as amended (16 USC 1531 *et seq*.).

In this biological opinion, NOAA Fisheries has determined that the proposed action is not likely to jeopardize the continued existence of Snake River spring/summer chinook salmon, Snake River steelhead, or Snake River sockeye salmon. NOAA Fisheries has also determined the proposed action is not likely to result in the destruction or adverse modification of critical habitat for Snake River chinook salmon or Snake River sockeye salmon. A complete administrative record of this consultation is on file with NOAA Fisheries' Habitat Division in Boise, Idaho. The duration of this biological opinion is through December 31, 2002, when the authorization of this proposal expires.

In addition to the biological opinion, enclosed as section 6, is a consultation regarding Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). NOAA Fisheries finds that the proposed action may adversely affect EFH for Snake River chinook salmon. NOAA Fisheries anticipates the terms and conditions from the ESA consultation will reduce adverse effects on EFH.

Ms. Janna Brimmer (208) 756-6496, and Ms. Jan Pisano (208) 756-6478 are the NOAA Fisheries contacts for this consultation.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

Enclosure

cc: D. Mignogno - FWS
T. Curet - IDFG
C. Colter - SBT
G. Matejko - USFS

Endangered Species Act Section 7 Consultation
Biological Opinion
and
Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Effects of the Bureau of Land Management Salmon and Challis Field Offices' 2002 Noxious Weed Control Program

Upper Salmon River Subbasin
Lemhi and Custer Counties, Idaho

Agency: Bureau of Land Management
Upper Columbia-Salmon/Clearwater District
Salmon and Challis Field Offices

Consultation Conducted By: National Marine Fisheries Service (NOAA Fisheries)
Northwest Region

Date Issued: 10/18/2002

Issued by: for Michael R Crouse
D. Robert Lohn
Regional Administrator

Refer to: F/NWR/2002/00473

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I. INTRODUCTION

The Bureau of Land Management (BLM) proposes to apply herbicides to lands managed by the Salmon and Challis Field Offices'. The purpose of the noxious weed control program is to control or eliminate noxious weed invasions and infestations on BLM lands through December 31, 2002. The BLM is proposing the action according to its authority under the Federal Noxious Weed Act of 1974, the Public Rangelands Improvement Act of 1978, the Carlson-Foley Act of 1968, and Executive Order 13112 on Invasive Species of February 3, 1999.

A. Background and Consultation History

The BLM initiated Endangered Species Act (ESA) and Essential Fish Habitat (EFH) consultations on the BLM Salmon and Challis Field Offices' 2002 Noxious Weed Control Program in a letter dated May 10, 2002, and received by NOAA Fisheries on May 13, 2002. The BLM provided a final Biological Assessment (BA) for the proposed action dated May 28, 2002. Prior to receiving the BA, the Level 1 team (Team) comprised of Salmon-Challis National Forest (SCNF), BLM, Fish and Wildlife Service (FWS), and NOAA Fisheries personnel discussed the proposed action at one or more meetings between January and April 2002. The BLM determined that the application of all proposed herbicides within the riparian area "May Effect, Likely to Adversely Affect" Snake River spring/summer chinook salmon, Snake River steelhead, and bull trout. The BLM determined that herbicide applications would have "No Effect" on Snake River sockeye salmon. The BLM also determined that the proposed action is not likely to adversely affect EFH for chinook salmon.

B. Proposed Action

Proposed actions are defined by NOAA Fisheries regulations (50 CFR 402.02) as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The proposed action occurs within designated critical habitat for Snake River spring/summer chinook salmon, and Snake River sockeye salmon, including all accessible habitat within the Upper Salmon River subbasin. Critical habitat was remanded for Snake River steelhead trout on April 30, 2002. The proposed action is also within designated EFH for chinook salmon. Because the BLM will implement the proposed action, a Federal nexus exists for interagency consultation under ESA section 7(a)(2).

The proposed activity consists of the application of herbicides on noxious weeds throughout lands administered by the Salmon and Challis Field Offices' of the BLM. The duration of this action is the 2002 field season, which begins on the signature date of this Opinion and ends no later than December 31, 2002. Applications will occur in seven watersheds, delineated by section 7 consultations (Table 1). Of these seven watersheds, three do not have listed salmon or steelhead species present and will not be analyzed. A detailed table showing specific application information is included in Appendix A.

Table 1. Section 7 watersheds and acreages to be treated in 2002.

Section 7 Watershed	Hydrologic Unit Number	Upland acres to be treated	Riparian acres to be treated
Middle Salmon-Panther	17060203	46.47	17.03
Lemhi	17060204	43.97	0.85
Pahsimeroi	17060202	21.33	21.75
Upper Salmon	17060201	114.88	11.15
Little Lost River[1]	17040217	-	-
Big Lost[2]	17040218	-	-
Birch Creek[3]	17040216	-	-
TOTALS		226.65	50.78

[1] The Little Lost River subbasin does not have listed salmon or steelhead species and will not be analyzed in this document.

[2] The Big Lost subbasin does not have listed salmon or steelhead species and will not be analyzed in this document.

[3] The Birch Creek subbasin does not have listed salmon or steelhead species and will not be analyzed in this document.

Noxious weeds and other species that may require chemical control within the project area include:

- Hoary Cress (whitetop) *Cardaria draba*
- Musk Thistle *Cardus nutans*
- Canada Thistle *Cirsium arvense*
- Diffuse Knapweed *Centaurea diffusa*
- Spotted Knapweed *Centaurea maculosa*
- Russian Knapweed *Acrptilon repens*
- Rush Skeletonweed *Chondrilla juncea*
- Leafy Spurge *Euphorbia esula*
- Perennial Pepperweed *Lepidium latifolium*
- Dalmation Toadflax *Linaria genistifolia*
- Yellow Toadflax *Linaria vulgaris*
- Purple Loosestrife *Lythrum salicaria*
- Black Henbane *Hyoscyanus niger*

Noxious weeds may be found in rangelands, in timber harvest areas, along roads and trails, at recreation sites, and sites disturbed by other events such as fires or floods. Several methods are available to control noxious weeds, including herbicide application, manual or mechanical control, biological control, grazing with goats, and cultural control measures. All of these control measures are proposed for use by the BLM. This biological opinion (Opinion) will only discuss the application of herbicides in the year 2002. The herbicides identified for use by the BLM are: clopyralid, 2,4-D, glyphosate, picloram, and sulfometuron-methyl. Of these, picloram has the greatest potential for negative effects to listed species, primarily because it is highly mobile and highly persistent. Glyphosate (Rodeo) and 2,4-D (Weedar 64 or Weedestroy) are the only chemicals proposed for use adjacent to water. Specific information on each of these herbicides can be found in Appendix B. The BLM frequently uses mixes of chemicals to treat areas where several weed species occur together and to increase the effectiveness of the herbicide. The most common of these mixes is a mixture of picloram and 2,4-D. The proposed application rates for each chemical are listed in Table 2.

Water will be used exclusively as the carrier for all chemicals in the proposed action. Adjuvants (additives used to enhance the performance or application characteristics of herbicides) proposed for use include Activator 90, Spread 90, L1700, Sylatac, R11, and MSO. Dyes are used to identify areas that have been treated. Dyes proposed for use by the BLM are Bullseye, Insight, and Hilight. The formulations of both adjuvants and dyes is frequently proprietary; therefore, the ingredients are unknown.

Table 2. Proposed and maximum label application rate for herbicides proposed for use by the BLM.

Herbicide	**Maximum Label Application Rate (lb ai/ac)**	**Proposed Typical Application Rate (lb ai/ac)**
Clopyralid	0.5	0.1-0.375
2,4-D	4.0	0.5-1.5
Glyphosate	3.75	0.5-2.0
Picloram	1.0	0.125-0.5
Sulfometuron-methyl[1]	2.25 oz	0.023-0.38 oz

[1] The use of sulfometuron-methyl on all public lands in Idaho remains suspended until BLM, Idaho State Office, Instruction Memorandum No. ID-2002-003 is explicitly rescinded by the Idaho State Director. Under this moratorium, the earliest this chemical could be used on public lands in Idaho would be the fall of 2002.

Herbicides would be applied with ground-based equipment; no aerial application is proposed. In addition to all applicable state, Federal, and local regulations, the proposed action includes the following measures to minimize or avoid adverse effects on salmon and steelhead, and their habitat:

- The BLM will follow established guidelines and best management practices as stated in: (1) BLM Manual 9011, *Chemical Pest Control*; (2) BLM Manual Handbook H-9011-1; (3) Final EIS, *Vegetation Treatment on BLM Land in Thirteen Western States*, May 1991; and (4) *BLM Salmon Field Office Noxious Weed Control EA*, 2001.

- The BLM will have a certified/licensed pesticide applicator overseeing all spray projects on-site.

- A spill cleanup kit will be available whenever pesticides (herbicides) are transported or stored.

- A spill contingency plan will be developed prior to all herbicide applications. Individuals involved in herbicide handling or application will be instructed on the spill contingency plan and spill control, containment, and cleanup procedures.

- Herbicide applications will only treat the minimum area necessary for the control of noxious weeds.

- During application, weather conditions would be monitored hourly by trained personnel at spray sites (i.e., wind speed, temperature, relative humidity). Additional weather and application monitoring would occur whenever a weather change may impact safe placement of the herbicide on the target area.

- All pesticide labels will be strictly enforced and other restrictions include the following:

  (a) Refer to Table 3 for maximum wind speed restrictions by herbicide application method.

  (b) Do not spray if precipitation is occurring or is imminent.

  (c) Do not spray if air turbulence is sufficient to affect the normal spray pattern.

  (d) Do not spray if snow or ice covers the target foliage.

  (e) No carrier other than water will be used.

- Within any 6th code Hydrologic Unit Code (HUC), no more than 1,000 acres of Federal (BLM and Forest Service [USFS]) herbicide application will occur annually.

- No use of 2,4-D ester formulations will be authorized.

- Annual Operating Plans for noxious weed control on public lands will integrate PACFISH/INFISH Riparian Management Objectives, standards and guidelines; RA-3, RA-4, RA-5, WR-2, WR-3, WR-4, FW-l. (Appendix IV)

- In stream-side areas, sprayers should travel in an up-stream direction wherever possible to dilute oversprays and use dye (e.g. In-sight Blue @ 2 oz./gallon) to provide a visual indication of coverage on non-target vegetation.

- Proper maintenance and calibration of spray equipment will occur at least annually to insure proper application rates.

- No spraying of picloram will occur within 100 feet of water if wind speed is greater than 5 miles per hour (mph).

- A pre-project review of all spray projects will be made by appropriate specialists (e.g., Fisheries Biologist, Ecologist, Botanist) and District Weed Coordinator to map and identify buffers, methods of application, and herbicide restrictions that may be required for the project.

- Equipment used for transportation, storage, or application of chemicals shall be maintained in a leak proof condition.

- No herbicide mixing will be authorized within 100 feet of any live waters. Mixing and loading operations must take place in an area where an accidental spill would not contaminate a stream or body of water before it could be contained.

- No spraying of picloram will be authorized within 50 feet of any live waters or shallow water tables.

- No more than one application of picloram will be made on an area in any given year to reduce the potential for picloram accumulation in the soil.

- Within 15 feet of live waters or areas with shallow water tables, the only herbicides authorized for use are aquatic approved herbicides and methods of control would include backpack sprayer, hand pump sprayer, wicking, wiping, dripping, painting, or injecting. The Weed Coordinator and the Fishery Biologist shall jointly determine the appropriate chemical or treatment technique to be used within the 0 to 15 foot zone on a site-by-site basis.

- No surfactants will be authorized for use within 15 feet of live waters or areas with shallow water tables. The surfactant R-900 will not be authorized for use.

- Only ground based spot/selective applications of herbicides rated as having a low level of concern for aquatic species will be authorized from 15 to 50 feet from live waters or within riparian areas (which ever is greater). Authorized spray equipment will include pick-up and all-terrain vehicle (ATV) mounted spray rigs (hand spot-gun only), backpack sprayer, hand pump sprayer, hand-spreading granular formulations, and wicking (e.g., also includes wiping, dipping, painting, or injecting target species).

- Only the quantity of herbicides needed for the day's operation will be transported from the storage area.

- Manual control (e.g., hand pulling, grubbing, cutting, etc.) is authorized in all areas, and may be used in sensitive areas to avoid adverse effects to non-target species or water quality. All noxious weed disposal will be in accord with proper disposal methods. Noxious weeds that have developed seeds will be bagged and burned.

- Buffers, wind speed restrictions, and application methods are listed in Table 3.

Table 3 - Buffers, maximum wind speed, application methods, and herbicide restriction

associated with aquatic habitats, riparian areas, and wetland resources by the BLM.

Buffer	Maximum Wind Speed[1]	Herbicide Application Method	Herbicides Authorized (Aquatic Level of Concern-see Table 6)
>100 feet from open water	10 mph	All ground/broadcast spraying	Low[2], Moderate[3]
<100 feet from open water, but >50 feet from open water	10 mph 5 mph Picloram	Spot spraying, wicking, dipping, painting, and injecting	Low[2], Moderate[3]
<50 feet from open water, but >15 feet from open water	5 mph	Spot spraying, wicking, dipping, painting, and injecting.	Low[2]
<15 feet from open water	5 mph	Spot spraying, wicking, dipping, painting, and injecting	Low, but aquatic approved herbicides only[4] No adjuvants except dyes

[1] Beaufort Wind Scale Information Summaries will be distributed to field applicators to assist in assessing ambient wind conditions.

[2] Low Level of Concern for Aquatic Species: clopyralid, 2,4-D, glyphosate,sulfometuron-methyl.

[3] Moderate Level of Concern for Aquatic Species: picloram.

[4] Aquatic approved herbicides: glyphosate, 2,4-D.

II. ENDANGERED SPECIES ACT

The Endangered Species Act of 1973 (16 USC 1531-1544), as amended, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with FWS and NOAA Fisheries, as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitats. This Opinion is the product of an interagency consultation pursuant to section 7(a)(2) of the ESA and implementing regulations found at 50 CFR 402.

A. Biological Opinion

The objective of this Opinion is to determine whether the BLM Salmon and Challis Field Offices' 2002 Noxious Weed Control Program is likely to jeopardize the continued existence of the Snake River spring/summer chinook salmon, Snake River sockeye salmon, or Snake River steelhead, or result in the destruction or adverse modification of designated critical habitat for the Snake River spring/summer chinook salmon and Snake River sockeye salmon.

1. Biological Information and Critical Habitat

The proposed action may affect the ESA-listed species and designated critical habitat identified below in Table 4. Based on life history timing for these evolutionary significant units (ESUs), it is likely that incubating eggs, juveniles, smolts, and adult life stages of these listed species would be affected by the proposed action.

The proposed action would also occur within designated critical habitat for the listed salmonid species within the specified action area. An action area is defined by NOAA Fisheries regulations (50 CFR Part 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area within designated critical habitat affected by the proposed action includes all accessible habitat within the Upper Salmon River subbasin. This area serves as migratory corridor for juveniles and adults, spawning, rearing, and growth and development to adulthood for the salmonid ESUs listed above.

Freshwater critical habitat includes all waterways, substrates, and adjacent riparian areas, areas adjacent to a stream that provides the following functions: shade, sediment, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter, below longstanding, natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and dams that block access to former habitat. The proposed action would occur in designated critical habitat for Snake River spring/summer chinook salmon and sockeye salmon and may affect essential features of critical habitat.

Essential features of critical habitat for the listed species are: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (juvenile only), (8) riparian vegetation, (9) space, and (10) safe passage conditions. The project activities are likely to affect the following essential features: water quality, food, and riparian vegetation.

Table 4. References for Additional Background on Listing Status, Biological Information, Protective Regulations, and Critical Habitat Elements for the ESA-Listed and Candidate Species Considered in this Consultation.

Species ESU	**Status**	**Critical Habitat**	**Protective Regulations**
Snake River Spring/Summer Chinook Salmon (*Oncorhynchus tshawytscha*)	April 22, 1992; 57 FR 14653, Threatened	October 25, 1999; 64 FR 57399[1]	July 10, 2000; 65 FR 42422
Snake River Sockeye Salmon (*O. nerka*)	November 20, 1991; 56 FR 58619, Endangered	December 28, 1993; 58 FR 68543	ESA section 9 applies
Snake River Basin Steelhead (*O. mykiss*)	August 18, 1997; 62 FR 43937, Threatened	February 16, 2000; 65 FR 7764; remanded April 30, 2002	July 10, 2000; 65 FR 42422

[1] This corrects the original designation of December 28, 1993 (58 FR 68543) by excluding areas above Napias Creek Falls, a naturally impassable barrier.

Snake River Spring/Summer Chinook

The Snake River spring/summer chinook salmon ESU, listed as threatened on April 22, 1992 (67 FR 14653), includes all natural-origin populations in the Tucannon, Grande Ronde, Imnaha, and Salmon Rivers. Some or all of the fish returning to several of the hatchery programs are also listed including those returning to the Tucannon River, Imnaha, and Grande Ronde hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. Critical habitat was designated for Snake River spring/summer chinook salmon on December 28, 1993 (58 FR 68543) and was revised on October 25, 1999 (64 FR 57399).

For the Snake River spring/summer chinook salmon ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period[1] ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to the effectiveness of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000). NOAA Fisheries has also estimated median population growth rates and the risk of absolute extinction for the seven spring/summer chinook salmon index stocks,[2] using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years for the wild component ranges from zero for Johnson Creek to 0.78 for the Imnaha River (Table B-5 in McClure et al 2000). At the high end, assuming that the

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[1] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1999 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

[2] McClure et al. (2000a) have calculated population trend parameters for additional SR spring/summer chinook salmon stocks.

hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years ranges from zero for Johnson Creek to 1.00 for the wild component in the Imnaha River (Table B-6 in McClure et al. 2000).

Historically, the Snake River drainage is thought to have produced more than 1.5 million adult spring/summer chinook salmon in some years during the late 1800s (Matthews and Waples 1991). By the 1950s the abundance of spring/summer chinook had declined to an annual average of 125,000 adults. Adult returns counted at Lower Granite Dam reached all-time lows in the mid-1990s (less than 8,000 adult returns), and numbers have begun to increase since 1997. Habitat problems are common in the range of this ESU. Spawning and rearing habitats are likely impaired by factors such as tilling, water withdrawals, timber harvest, grazing, mining, and alteration of floodplains and riparian vegetation. Mainstem Columbia River and Snake River hydroelectric developments have altered flow regimes and estuarine habitat, and disrupted migration corridors. Competition between natural indigenous stocks of spring/summer chinook salmon and spring/summer chinook of hatchery origin has likely increased due to an increasing proportion of naturally-reproducing fish of hatchery origin.

Compared to the greatly reduced numbers of returning adults for the last several decades, exceptionally large numbers of adult chinook salmon returned to the Snake River drainage in 2000 and in 2001. These large returns are thought to be a result of favorable ocean conditions, and above average flows in the Columbia River Basin when the smolts migrated downstream. These large returns are only a fraction of the returns of the late 1800s. Recent increases in the population are not expected to continue, and the long-term trend for this species indicates a decline. Detailed information on the current range-wide status of Snake River chinook salmon under the environmental baseline, is described in the Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California (Myers et al 1998).

Snake River Steelhead

The Snake River steelhead ESU, listed as threatened on August 18, 1997 (62 FR 43937), includes all natural-origin populations of steelhead in the Snake River basin of southeast Washington, northeast Oregon, and Idaho. None of the hatchery stocks in the Snake River basin are listed, but several occur within the ESU. Critical habitat for Snake River steelhead was administratively withdrawn on April 30, 2002, therefore critical habitat is not designated at this time.

For the Snake River steelhead ESU as a whole, NOAA Fisheries estimates that the median population growth rate (lambda) over the base period[3] ranges from 0.91 to 0.70, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000). NOAA Fisheries has also estimated the risk of absolute extinction for the A- and B-runs, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.01 for A-run steelhead and 0.93 for B-run fish (Table B-5 in McClure

[3] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1997 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

et al. 2000). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 for both runs (Table B-6 in McClure et al. 2000).

Natural runs of Snake River steelhead have been declining in abundance over the past decades. Some of the significant factors in the declining populations are mortality associated with the many dams along the Columbia and Snake Rivers, losses from harvest, loss of access to more than 50% of their historic range, and degradation of habitats used for spawning and rearing. Possible genetic introgression from hatchery stocks is another threat to Snake River steelhead since wild fish comprise such a small proportion of the population. Additional information on the biology, status, and habitat elements for Snake River steelhead are described in Busby et al (1996).

The 2000 and 2001 counts at Lower Granite Dam indicate a short-term increase in returning adult spawners. Adult returns (hatchery and wild) in 2001 were the highest in 25 years and 2000 counts were the sixth highest on record (Fish Passage Center 2001a). Increased levels of adult returns are likely a result of favorable ocean and instream flow conditions for these cohorts. Although steelhead numbers have dramatically increased, wild steelhead comprise only 10% to 20% of the total returns since 1994. Consequently, the large increase in fish numbers does not reflect a change in steelhead status based on historic levels. Recent increases in the population are not expected to continue, and the long-term trend for this species indicates a decline.

Survival of downstream migrants in 2001 was the lowest level since 1993. Low survival was due to record low run-off volume and elimination of spills from the Snake River dams to meet hydropower demands (Fish Passage Center 2001b). Average downstream travel times for steelhead nearly doubled and were among the highest observed since recording began in 1996. Consequently, wide fluctuations in population numbers are expected over the next few years when adults from recent cohorts return to spawning areas. Detailed information on the current range-wide status of Snake River steelhead, under the environmental baseline, is described in the Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and Washington (Busby et al 1996).

Snake River Sockeye Salmon

Snake River sockeye salmon enter the Columbia River in late spring and early summer and reach the spawning lakes in late summer and early fall. The entire mainstem Salmon River has been designated as critical habitat for sockeye salmon (50 CFR Part 226, December 28, 1993); however, spawning and rearing habitat is in the Upper Salmon subbasin (upstream from the action area) in lands managed by the Sawtooth National Recreation Area (SNRA). The portion of the Salmon River within the action area is primarily used as a migration corridor. Application of herbicides on BLM land will in most cases be many miles away from the main corridor. The BLM determined that the proposed action will have no effect on sockeye salmon. NOAA Fisheries concurs with this determination, and sockeye salmon will not be addressed again in this Opinion.

2. Evaluating the Proposed Action

The standards for determining jeopardy and adverse modification of critical habitat are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402.02 (the consultation regulations). In conducting analyses of habitat-altering actions under section 7 of the ESA, NOAA Fisheries uses the following steps of the consultation regulations combined with the Habitat Approach (NMFS 1996): (1) Consider the status and biological requirements of the species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status; (3) determine the effects of the proposed or continuing action on the species; (4) consider cumulative effects; and (5) determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival in the wild or adversely modify its critical habitat. In completing this step of the analysis, NOAA Fisheries determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species or result in the destruction or adverse modification of critical habitat. If either or both are found, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action (including "harm" and other forms of take). NOAA Fisheries' critical habitat analysis considers the extent to which the proposed action impairs the function of essential elements necessary for juvenile and adult migration, spawning, and rearing of the listed salmon and steelhead under the existing environmental baseline. When analyzing herbicide applications, NOAA Fisheries establishes risks to listed species by considering the toxicity of herbicides proposed for use, and examining the likelihood of exposure of listed species to those herbicides.

Recovery planning will help identify feasible measures that are important in each stage of the salmonid life cycle for conservation and survival within a reasonable time. In the absence of a final Recovery Plan, NOAA Fisheries must ascribe the appropriate significance to actions to the extent available information allows. NOAA Fisheries intends that recovery planning identify areas/stocks that are most critical to species conservation and recovery from which proposed actions can be evaluated for consistency under section 7(a)(2).

Biological Requirements in the Action Area

The first step NOAA Fisheries uses when applying the ESA section 7(a)(2) to the listed ESUs considered in this Opinion is to define the species' biological requirements within the action area. NOAA Fisheries also considers the current status of the listed species taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species within the action area, NOAA Fisheries starts with the determinations made in its decision to list for ESA protection the ESUs considered in this Opinion and also considers any new data that is relevant to the determination.

Relevant biological requirements are those necessary for the listed ESU's to survive and recover to naturally reproducing population sizes at which protection under the ESA would become unnecessary. This will occur when populations are large enough to safeguard the genetic diversity of the listed ESUs, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. Interim recovery objectives developed by the Interior Columbia Technical Recovery Team are identified in Table 5 (NMFS 2002). For this consultation, the relevant biological requirements are water quality, food availability, and riparian vegetation that function to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and growth and development to adulthood.

Table 5. Interim abundance targets of spawners returning to each watershed.
From NMFS (2002).

ESU	Spawning Aggregation	Spawning Aggregation Abundance Target
Snake River Spring/Summer Chinook Salmon	Mainstem Tributaries (Middle Fork to Lemhi)	700
	Lemhi River	2200
	Pahsimeroi (summer)	1300
	Mainstem Tributaries (Summer) (Lemhi to Redfish Lake Creek)	2000
	Mainstem Tributaries (Spring) (Lemhi to Yankee Fork)	2400
	Upper East Fork Tributaries (Spring)	700
	Upper Salmon Basin (Spring)	5100
Snake River Sockeye Salmon		1000 spawners in one lake; 500 spawners per year in a second lake
Snake River Steelhead	Upper Salmon	4700
	Lemhi	1600
	Pahsimeroi	800

Snake River Spring/Summer Chinook. Habitat requirements of spring/summer chinook salmon vary by season and life stage, and they occupy a diverse range of habitats. Distribution and abundance of spring/summer chinook salmon may be influenced by cover type and abundance, water temperature, substrate size and quality, channel morphology, and stream size. The present range of spawning and rearing habitat for the naturally spawned Snake River spring/summer chinook salmon ESU is primarily limited to the Salmon, Grande Ronde, Imnaha, and Tucannon drainages. In addition to these major drainages, Asotin, Granite, and Sheep Creeks provide minor amounts of spawning and rearing habitat (CBFWA 1990).

Life histories of spring/summer chinook salmon are highly variable, both among and within populations, enabling salmon to adapt to a wide range of physical circumstances (Thorpe 1994). Most adult Snake River spring/summer chinook salmon return to natal streams from May through September. Spawning generally occurs in mid-August through the end of September. In Idaho, most spawning areas for spring/summer chinook salmon are found in streams at elevations of roughly 3,000 to 6,500 feet. Cover is essential for adult chinook salmon prior to spawning, especially for early migrants which remain in tributaries for several months prior to spawning. Temperature may influence the suitability of spawning habitat. The primary evolutionary factor determining the time of spawning may be the number of temperature units required for successful incubation. Survival and emergence success of Snake River chinook salmon embryos can be limited by fine sediment and low flows (Chapman 1988). Other potential factors that affect egg-to-fry survival include redd disturbance, bottom scour, microbial infection, and water quality (Healey 1991).

Juvenile spring/summer chinook salmon emerge from spawning gravels from February through June (Peery and Bjornn 1991). After emergence, fry concentrate in shallow, slow water near stream margins with cover (Hillman et al 1987). As fry grow, they occupy deeper pools with submerged cover during the day and shallower inshore habitat at night. Elevated levels of sediment, from roads and other land disturbances, affects growth and survival of juvenile chinook salmon in many parts of the Snake River drainage. Fine sediment deposition can reduce habitat capacity by filling small spaces between rocks, and when suspended, it may result in damaged gills, reduced feeding, avoidance of sedimented areas, reduced reactive distance, suppressed production, and increased mortality (Reiser and Bjornn 1979). Key habitat factors for juvenile rearing include streamflow, pool morphology, cover, and water temperature (Steward and Bjornn 1990). Chinook salmon parr tend to select specific rearing habitats that segregate them, both temporally and spatially, from other native salmonids (Everest and Chapman 1972). They also tend to be most abundant in low gradient, meandering stream channels. Juvenile salmon often occupy different habitats in winter than in summer with two overwintering strategies, which include migration and concealment cover beneath cobble or rubble substrate or beneath undercut banks (Hillman et al 1987).

Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in April and May (Bugert et al 1990; Cannamela 1992). After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration, which lasts 2 to 3 years. Because of their timing and ocean distribution, these stocks are subject to very little ocean harvest. For detailed information on the life history and stock status of Snake River spring/summer chinook salmon, see Matthews and Waples (1991), NMFS (1991), and 56 FR 29542 (June 27, 1991).

Snake River Steelhead. Steelhead can be divided into two basic run-types based on the state of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, while others only have one run-type.

In the Pacific Northwest, summer steelhead enter fresh water between May and October (Busby et al 1996; Nickelson et al 1992). During summer and fall, prior to spawning, they hold in cool, deep pools (Nickelson et al 1992). Snake River steelhead migrate inland toward spawning areas from June through October. They overwinter in the larger rivers, and resume migration in early spring to natal streams, where they spawn (Meehan and Bjornn 1991; Nickelson et al 1992). Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986; Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation prior while they are staged at spawning areas. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973) are required to reduce disturbance and predation of spawning steelhead. Steelhead are iteroparous, or capable of spawning more than once before death. However, few Snake River steelhead spawn more than once due to stress from the long migration distance, and relatively poor physical condition of the fish after spawning.

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al 1992).

Juveniles rear in fresh water for 1 to 4 years, then migrate to the ocean as smolts. Snake River steelhead generally rear in smaller streams for 2 years, but can range from 1 to 4 years and occasionally up to 7 years with some becoming resident (Busby et al 1996). Steelhead typically reside in marine waters for 2 or 3 years prior to returning to their natal stream to spawn at 4 or 5 years of age. Age structure appears to be similar to other west coast steelhead, dominated by 4-year-old spawners (Busby et al 1996).

Environmental Baseline

The environmental baseline includes "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation and the impacts of state and private actions that are contemporaneous with the consultation in progress" (50 CFR 402.02). In step 2 of NOAA Fisheries' evaluation of jeopardy/adverse modification of critical habitat it evaluates the relevance of the environmental baseline in the action area to the species current status.

In describing the environmental baseline, NOAA Fisheries emphasizes essential elements of designated critical habitat or habitat indicators for the listed salmonid ESUs affected by the proposed action. The action area is described in section I.B. of this document. NOAA Fisheries does not expect untreated areas of the Upper Salmon River subbasin to be directly or indirectly affected by the proposed action.

Upper Salmon Subbasin. The Upper Salmon subbasin contains the following section 7 watersheds, as delineated in the chinook and sockeye salmon watershed biological assessments: Morgan Creek, Challis Creek, Squaw Creek, Thompson Creek, Yankee Fork, and the East Fork Salmon River. To facilitate adequate discussion of baseline conditions, the watersheds will be discussed individually in this Opinion.

<u>Morgan Creek</u>. Morgan Creek is a tributary to the Salmon River, entering several miles below the town of Challis. The watershed is approximately 77,305 acres in size and contains 150 miles of perennial streams and 48 miles of intermittent streams. The USFS administers 52,215 acres, the BLM 21,397, and 3,693 acres are under private ownership. Elevations range from 4800 to

7800 feet. Two different kinds of geologic parent material exist within the watershed: volcanics and metamorphics. Stream gradients vary from 1.5% to 4.3%, and most channels are a Rosgen type B (USDA 1994d).

Vegetation varies by elevation and aspect, with sagebrush steppe common in the lower and drier portions of the watershed. Associates are pinegrass, bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue. Intermediate elevations support mountain mahogany, Douglas fir, and lodgepole pine. Higher elevations have wet and dry meadows with Idaho fescue, sedges, timber oatgrass, smooth brome, bluebunch wheatgrass, western wheatgrass, and numerous forbs. Riparian vegetation is in two distinct habitats. Within the steep, rock walled lower canyon, cottonwoods and dogwoods are common. Further up, where the canyon opens up into a broad valley, riparian vegetation consists of willow, sedge, and rush communities. In some areas of private land adjacent to Morgan Creek, riparian vegetation has been removed to favor pasture grasses (USDA 1994d).

Primary impacts on stream quality come from sediments associated with roads and grazing activities. Irrigation water withdrawals also have a significant impact on Morgan Creek, sometimes dewatering Morgan Creek in the summer. In addition, many of the diversions in this watershed are unscreened (USDA 1994d). Grazing in Morgan Creek has been an on-going concern, with several pastures repeatedly not meeting standards. Cooperative management with the grazing association has resulted in improved range quality in many areas, but several pastures are still not within standards. In 2002, the action agencies began reinitiating consultation on grazing management within the Morgan Creek allotment (SCL1 2002).

Low water caused by irrigation water withdrawals make all but the lower 7 miles of Morgan Creek inaccessible to chinook salmon. Also, there is a cascade near the BLM campground that is impassable to salmon because of low water caused by excessive irrigation withdrawals. The cascade is not a barrier to steelhead because they cross it during higher water in the spring (USDA 1994d).

<u>Challis Creek</u>. Challis Creek watershed includes Challis Creek and Garden Creek, both of which enter the Salmon River just below the city of Challis. Challis Creek flows 22.3 miles, and Garden Creek is 17 miles long. The entire watershed is approximately 129,280 acres, with 44.1 miles of perennial streams and 146.4 miles of intermittent streams (USDA 1994b). Land ownership is 63.6% USFS, 24.5% BLM, and 11.9% private. Most of the land adjacent to Challis and Garden Creeks is under private ownership (USDA 1994b).

Channel types range from Rosgen types A and B in high gradient reaches to type C in lower gradients and meadow complexes. Elevations range from 4,800 to over 10,300 feet. Geology is generally either Paleozoic (600 to 450 million years old) sedimentary, or Eocene (50 to 45 million years old) volcanic or intrusive. The sedimentary rocks are primarily siltstone or sandstone which has been metamorphosed to slate and quartzite, and the volcanics are of varied types. Two million years ago signaled the beginning of an ice age that covered much of the central Idaho mountains with glaciers. In this watershed, the headwaters of Challis Creek, Bear Creek, and Garden Creek originate in glacial valleys. Soils are poorly to moderately developed, with those formed from volcanic rock tending to be sandy to loamy, and those on sedimentary rock tending to be clay rich. Flourspar, gold, and silver deposits are present in this watershed (USDA 1994b).

Vegetation in this watershed varies by aspect and elevation. Lower elevations support sagebrush with pinegrass, bluebuch wheatgrass, Idaho fescue, Sandberg bluegrass, and annual grasses. The ridges at intermediate elevations have mountain mahogany, Douglas fir, lodgepole pine, and small stands of aspen and spruce at wetter sites. High elevations support wet and dry meadows of Idaho fescue, Carex *spp.*, timber oatgrass, smooth brome, bluebunch wheatgrass, western wheatgrass, and numerous forbs (USDA 1994b). Riparian areas are dominated by cottonwood, willow, and alder.

A dam exists to create Mosquito Flat Reservoir, and Challis Creek Lakes, Spruce Gulch, and West Fork of Bear Creek are used for water storage (USDA 1997). All these impoundments are used for irrigation. Diversions exist on all perennial streams in this watershed, and this watershed is not currently utilized by anadromous fish because (1) both Challis and Garden Creeks are dewatered during the irrigation season; and (2) habitat that was likely used for spawning historically has been degraded (USDA 1994b). A total of 3.2 miles of Challis Creek, 4.0 miles of Darling Creek, and 12 miles of Garden Creek have been identified as potential spawning/rearing habitat (USDA 1994b).

Squaw Creek. Squaw Creek is a tributary to the Salmon River, located just above the town of Challis, Idaho. The watershed consists of Squaw Creek, Kinnikinik Creek, Bayhorse Creek, and several small tributaries on the north side of the river. It also contains Spud and Sullivan Creeks on the south side. The watershed contains approximately 134,750 acres. Of that, 52.6% is administered by the Forest Service (SNRA and Yankee Fork Ranger District). The BLM manages 40.4%, private landowners hold 4.5%, and the State of Idaho owns 2.4%. This watershed contains 139.3 miles of perennial streams and 293.9 miles of intermittent streams. Approximately 42.6 miles of stream are considered active or potential chinook salmon spawning habitat (USDA 1994a).

Elevations in the watershed range from 5200 feet at the mouth of Bayhorse Creek to 10,072 feet on Bald Mountain. Stream gradients range from less than 0.5% in the Main Salmon River to over 25% in Potoman Creek. Channel types are primarily Rosgen type B, with some A channels in small tributaries and headwaters, and C channels near the mouths of streams. The geology of the area is very complex and contains sedimentary and volcanic rocks. As a result, soil types vary from coarse, sandy soils to clays. Generally, erosion rates are lower in clay soils than soils of granitic origin, but areas with clays are more susceptible to blowouts (USDA 1994a).

Water quality is significantly impaired by roads, grazing, and mining. Roads are a major source of sediment in the watershed, mostly because the steep topography dictates that roads follow closely to stream channels. Road density is 1.06 miles of road per square mile. Grazing on public lands occurs throughout most of the watershed. Grazing on private land adjacent to the Salmon River has in some cases resulted in degraded streambanks and riparian areas (USDA 1994a).

The Squaw Creek watershed is very rich in minerals. The Cyprus Thompson Creek Mine molybdenum pit and mill are located on the ridge separating Squaw Creek from Thompson Creek. The ore conveyor system, mill, main access road, tailings pond, and associated water and power lines are located in the Squaw Creek watershed, while the remainder of the operation is in the Thompson Creek drainage. The 1994 Biological Assessment states that "numerous spills of fuels and hazardous substances have been documented..." but that "measurable amounts have not reported to have reached salmon habitat." (USDA 1994a). However, on October 18, 2001, a loaded molybdenum truck from Thompson Creek Mine overturned on Highway 75 above Challis, dumping 33,000 pounds of molybdenum disulfide into the Salmon River. The truck did not enter the river. Initial follow-up sampling showed a distribution of the product for at least

6 miles downstream. Molybdenum disulfide is a fine powder, and is stable and inert. Effects on resident and anadromous fish are expected to be negligible, but monitoring is continuing. Effects are expected to be greatest on chinook redds near Challis (Brimmer 2002).

Other mineral activities in the Squaw Creek watershed include small pick and shovel mines and larger, inactive mines. These include the Clayton Silver Mine on Kinnikinic Creek and several old mines in the Bayhorse drainage (USDA 1994a). Phase I of reclamation on the Clayton Silver Mine has been completed and is being monitored. The BLM expects to perform additional riparian plantings during the fall of 2002, and to slightly modify the channel to improve the meander pattern and width (Forster pers. comm.).

Several projects have been implemented in the Squaw Creek watershed to rehabilitate fish habitat degraded by cattle grazing. These include the Aspen Creek Watershed Rehabilitation project, which installed several check dams in 1958 to control downcutting. The area was closed to grazing from 1958 to 1965, but was grazed by trespass cattle nearly every year. As a result, the gullies were still unstable and treatments were only partially successful according to a 1970's follow-up report. Since then, vegetation has improved, but raw banks and other damage is still present (USDA 1994a). In addition, several thousand willows were planted along Squaw Creek, and some tree deflectors were installed. The BLM installed several rock and eddy and V-shaped rock eddy structures in the Salmon River near Lyon and Bayhorse Creeks to provide pocketwater for rearing salmonids (USDA 1994a).

Riparian vegetation along the Salmon River consists of a narrow strip of dogwood, willow, and alder, with occasional cottonwood or conifers. Most of the riverbank is very steep. The riparian areas along the tributaries are characterized by cottonwood, rose, aspen, willow, and alder. Some areas are stable or improving, while others are showing a downward trend due to heavy grazing. In these areas, riparian vegetation is heavily hedged and in some places the creeks are getting shallower and wider (USDA 1994a). Grazing management has since changed in these areas to shorter rotations and/or fewer numbers. The noxious weed, leafy spurge, is present in patches along the Salmon River.

Upland vegetation is variable, but consists of subalpine fir types on the ridges, Douglas fir/pine communities on cooler sites, and Douglas fir/heartleaf arnica on drier sites. The south aspects support sagebrush/grass communities with some Douglas fir or lodgepole pine on wetter sites. Generally, the area is in mid to late seral stage (USDA 1994a).

Several irrigation diversions exist within this watershed. Diversions along the Salmon River do not appear to affect edge-water rearing habitat, but Bayhorse Creek and Squaw Creek are often dewatered. In addition, Kinnikinik Creek, Spud Creek, and Birch Creek have reduced flows during the summer (USDA 1994a).

<u>Thompson Creek</u>. The Thompson Creek watershed is 37,939 acres and has a wide variety of topography, ranging from 8,500 feet high peaks, cirque basins, steep slopes, narrow canyon bottoms, and broad benches. Vegetation consists of lodgepole pine, Douglas fir, Engelmann spruce, subalpine fir, whitebark pine, and Wyoming and big sagebrush communities. Most of the watershed is under Federal ownership, with the SCNF (30,007 acres), the BLM (6,454 acres), and the SNRA (896 acres) as managing agencies. There are also 582 acres of privately owned land in this watershed, with the Cyprus Thompson Creek Mine holding 518 of those acres for molybdenum extraction. The remainder is in private residences near the mouth of the watershed. There are approximately 50 miles of perennial and 91 miles of intermittent streams in this watershed (USDA 1994c).

Only three streams in the Thomson Creek watershed analysis area have the potential for steelhead or chinook spawning based on gradient, substrate, and the presence of perennial water. These are Thompson Creek, Gardner Creek, and Peach Creek. Of those, only Thompson Creek has suitable habitat for chinook salmon (USDA 1994c). Chinook salmon are currently using the lower 12 miles of Thompson Creek. Thompson Creek habitat has been affected by low flows, which can be attributed to drought, hydrological changes due to mining activities, and irrigation withdrawals. Peach Creek is almost entirely dewatered by irrigation withdrawals, but does provide rearing habitat for juvenile chinook salmon from the mouth to the highway bridge (Pisano pers. comm). Gardner Creek also has low flows due to natural conditions and irrigation withdrawals (USDA 1994c).

Yankee Fork. The Yankee Fork watershed consists of approximately 121,578 acres (190 square miles), and has 223 miles of perennial streams and 291 miles of intermittent streams. The length of the mainstem Yankee Fork drainage is 26 miles, and the river ranges in elevation from 5,950 feet at the confluence with the Salmon River to 8500 feet. The West Fork Yankee Fork is approximately 10.3 miles long and ranges from 6200 feet to 7800 feet. The watershed is of varied geologic origin and the peaks rise from between 9,000 and 10,000 feet. The valley floors may be as much as 3,500 feet below the ridges. Principal tributaries are the West Fork Yankee Fork, Jordan Creek, Eight Mile Creek, and McKay Creek. Smaller tributaries include Fourth of July Creek, Adair Creek, Slaughterhouse Creek, and Five Mile Creek. Several of the drainages head in broad U-shaped valleys of glacial origin but transition to steep, V-shaped canyons (USDA 1995).

The most abundant rock types in the Yankee Fork drainage consist of lava flow, tuff, and intrusive basalt, dactite, latite, and rhyolite. This volcanic history resulted in rich hardrock mineral deposits. Between 2 million and 14,000 years ago, there were at least four major alpine glacial events in central Idaho. These events carved the steep cirque walls and U-shaped valley floors seen in many areas of the region. The placer gold deposits in the Yankee Fork and Jordan Creek were formed at this time. Several faults are in the central Idaho region and earthquakes are common. Soil quality in the Yankee Fork drainage is poor and is generally only 3 to 9 inches deep (USDA 1995).

The vegetation in the Yankee Fork drainage varies with elevation and aspect, but is generally characteristic of montane and subalpine communities. Lower south-facing slopes have sagebrush communities, while low and mid elevations have Douglas fir communities. Higher valley bottoms and slopes have subalpine fir along with lodgepole pine and Engelmann Spruce. Many dredged areas support alder communities (USDA 1995).

The Yankee Fork drainage has a long history of mining and has been severely affected by associated activities. Several small mining towns were active in the basin beginning in the late 1800's and 6 miles of the mainstem Yankee Fork and 1.5 miles of Jordan Creek were dredge mined in the 1950's. Many of the channels that have reestablished following the dredging are channelized between tailing piles and cannot access their floodplains. Most of the tailings are barren of vegetation. As a result of the dredging operations, most rearing and spawning habitat in the lower Yankee Fork has been eliminated. Pool habitat, cover, and spawning gravel availability are limiting factors (USDA 1995).

Several rehabilitation projects have been performed in the basin by the Shoshone-Bannock Tribes, Hecla Mining Company, and the USFS, among others, so many areas that were unavailable to anadromous fish are now partially rehabilitated (USDA 1995).

East Fork Salmon River. The East Fork of the Salmon River is included in the Upper Mainstem Salmon River section 7 watershed. The East Fork is typical of the Upper Salmon River, and is located along the southeastern boundary of the Salmon River watershed and is a major tributary to the upper Salmon River. The East Fork drains approximately 560 square miles, including the White Cloud Mountain Range. Major tributaries are Herd Creek, Big and Little Boulder Creeks, Germania Creek, and Bowery Creek. Other creeks are Lake Creek, Road Creek, and Fox Creek, but these generally do not provide year-round water to the East Fork. The watershed has approximately 95 stream miles of spawning and rearing habitat (Bonneville Power Administration 1991). This watershed is located entirely in Custer County, Idaho, and the confluence is approximately 18 miles south of the town of Challis and about 5 miles east of the town of Clayton. The SCNF, SNRA, and the BLM manages approximately 85% of the watershed (Idaho Soil Conservation Commission 1995). However, most of the land immediately adjacent to the East Fork is privately owned.

The East Fork drainage area is very steep, and elevations range from 5345 feet at the mouth of the East Fork up to 11,487 feet within the White Cloud Mountain Range (USDI-BLM 1998a). The river is a low to medium gradient system, and the valley floor is generally gravelly and unsuited to cultivation. The geology of the area is characterized by a thick layer of rock comprised of volcanic flows and ash deposits. Alluvial and glacial deposits border most of the East Fork and its tributaries, and the valley floors are depositional. Local faults and folding also occurred, but no active faults have been identified within the watershed (Bonneville Power Administration 1991).

Several valleys at lower elevations are wide, U-shaped troughs formed by valley bottom glaciation. Lateral moraines form long terraces that extend into the valley. The gravels in the flat East Fork valley bottom are derived from glacial outwash. As glaciers receded, they left large depressions that subsequently filled with water, outwash gravels, and fine lake-type sediments. These small lakes eventually became meadows, and thick mats of organic material formed from the accumulation of years of vegetation growth and seasonal die-off. When the integrity of this mat is maintained, it stores and releases large quantities of water that ensures constant streamflows. When this layer is trampled, however, streambank stability is quickly lost and erosion is accelerated (USDI-BLM 1998a).

Streamflow regimes in the East Fork are similar to other watersheds in the Salmon River Basin. Water flow is high in the spring and declines into summer with annual minimum flows occurring about September. Early spring rains sometimes increase runoff before snowmelt begins. Rainfall during the fall often produces a secondary rise in flows which lasts into the winter (USDI-BLM 1998a). Channel types range from Rosgen A type in the higher gradient headwater reaches to C types in the lower gradient and meadow complexes. The relatively high elevation promotes a short growing season and directly influences the riparian and upland vegetation (USDI-BLM 1998a).

Human activities since the mid 1800's are likely to have changed the hydrology of the East Fork Salmon River as a result of beaver trapping and dam removal, stream channel alteration, rip-rapping, riparian vegetation removal, and diversion of flows for irrigation. Reduced streamflow access to the floodplain has changed hydrography of the system from one that slowly releases stored water to one that releases water within a shortened timeframe, resulting in lower late summer flows and higher water temperatures (USDI-BLM 1998a).

Soils within the headwaters of the East Fork are composed of limestone. The remaining portion of the watershed is of basalt origin. Both soil bases are considered productive in terms of providing minerals for terrestrial plant growth and the base of the aquatic food chain. These soils are considerably more productive than the granitics which are found to the west. As the parent materials for these soil types weather, they provide a fine-textured soil that traps organic material quite well, creating opportunity for vegetation to grow quickly. Also, these soils ultimately will hold water better than the loose-textured granitics. However, if disturbed these soils can erode into streams distributing very fine sediments that can have devastating results to incubating and young salmonids. The volcanic soils in the lower reach of the watershed, particularly in Spar Canyon and Road Creek, are also very erosive (USDI-BLM 1998a).

Riparian habitats involve not only riverine and lacustrine ecosystems, but also include vegetation associated with seeps, springs meadows, bogs, and ponds. Riparian habitats consist mainly of deciduous trees and plant species that are adapted to a moist environment. The community plant structure within riparian habitat may vary depending on frequency of flooding, amount of scouring, and past disturbance. The riparian areas commonly support black cottonwood, quaking aspen, Douglas-fir, mountain maple, Wood's rose, willow, red-osier dogwood, choke cherry, gooseberry, currant, horsetail rush, Kentucky bluegrass, rushes, and sedges (USDI-BLM 1998a).

The upland vegetation of the East Fork watershed is dominated by coniferous forests with deciduous hardwoods interspersed along the watercourses. Highly productive mixed conifer stands at low to middle elevations consist mainly of ponderosa pine, Douglas fir, and lodgepole pine. At higher elevations, the moderately productive conifer species are Englemann spruce, subalpine fir, and lodgepole pine. Understory vegetation in the forested areas consists of various shrubs, forbs and grasses. Drier areas support grassland vegetation on sites where trees are scattered or absent. These lower elevation lands consist of a sagebrush/grass complex. Varieties of sagebrush dominate the watershed below 16 inches of annual precipitation. Mixed salt shrub types are also present below 10 inches of annual precipitation. Herbaceous understories include bluebunch wheatgrass, Idaho fescue, needle grasses, squirrel tail, and varies perennial and annual forbs (USDI-BLM 1998a).

Many species of noxious weeds are known to occur within the action area. These species may or may not be found within the East Fork watershed, and include whitetop, musk thistle, diffuse knapweed, spotted knapweed, Russian knapweed, rush skeletonweed, Canada thistle, poison hemlock, field bindweed, leafy spurge, black henbane, yellow toadflax, scotch thistle, and perennial sowthistle (USDI-BLM 1998b). Special status plant species within this watershed include three species of milkvetch, Silvery draba, White aetonella, Challis crazyweed, and Wavy leaf thelypody (USDA and USDI-BLM 1997; USDI-BLM 1998b).

Federal land management in the East Fork watershed includes the USFS (211,720 acres) with the SNRA of the Sawtooth National Forest and the Yankee Fork Ranger District of the SCNF. The BLM is the second largest landholder with 123,452 acres, and the State of Idaho has 9,251 acres scattered throughout the watershed. Private ownership accounts for 6,482 acres, but 80% of occupied salmon habitat is located on private ground (USDI-BLM 1998a). Grazing is the most common land use in the drainage, and mining has been a major influence in the past. An inactive mine exists along Big Boulder Creek, and there are gold mining reserves in the White Clouds (Idaho Soil Conservation Commission 1995). Logging is not a major factor in this watershed.

Hay operations and pastures are the primary users of irrigation water. Approximately 2,600 acres are irrigated in this watershed. Flood irrigation is most common, and water supply exceeds the demand. No storage reservoirs or irrigation wells are present in this drainage (Idaho Soil Conservation Commission 1995).

The East Fork provides spawning and rearing habitat for spring/summer chinook salmon and steelhead. Resident fish within the East fork drainage include Westslope cutthroat trout, bull trout, rainbow trout, and mountain whitefish.

Pahsimeroi Subbasin. Current and historic anadromous fish habitat in the Pahsimeroi watershed consists of the mainstem Pahsimeroi from the mouth to the headwaters, all major drainages along the northeast side and their drainage basins, including all the drainages in Little Morgan, Tater, Morse, Falls, Patterson, Big, Goldburg, and Burnt Creeks. The East Fork Pahsimeroi, West Fork Pahsimeroi, Rock Creek, and Mahogany Creek are also critical habitat. Total watershed area is 537,210 acres (839 square miles); of that, 41.7% (224,278 acres) is under BLM management, 8.8% (47,035 acres) is under private ownership, 3.6% (19,159 acres) is owned by the State of Idaho, and the USFS manages 45.9% (246,717 acres). Ownership distribution generally lies in bands, with privately owned lands adjacent to the rivers and streams, BLM land sits on the benches, and Forest land is situated in the upper watersheds. State land is interspersed throughout the basin (USDI-BLM 1999b).

The mouth of the Pahsimeroi watershed is approximately 38 miles south of the city of Salmon along the Salmon River. The watershed is bound by the Lemhi Range to the northeast, which rises to 11,350 feet (Big Creek Peak), and by the Lost River Range to the southwest, which includes the highest peak in Idaho, Mount Borah (12,662 feet). The Lemhi Range is primarily volcanic in origin, while the Lost River Range is limestone. These geologic differences result in vast hydrologic differences in the two sides of the valley. The limestone promotes percolation of surface water and the volcanic geologies promote runoff. The Lemhi Range also has greater snowpack than the Lost River Range, which causes the north side of the valley to have greater flow than the south (USDI-BLM 1999b).

The valley floor has a low elevation of 4,648 feet and ranges from 1 to 10 miles in width, with a maximum width of 26 miles. The Pahsimeroi River is approximately 50 miles long and originates on the north face of Leatherman Peak in the Lost River Range. The mouth of each drainage has well developed alluvial fans, which can be up to 3000 feet in depth. These fans are composed of boulders, cobbles, and gravels, and constitute a large underground reservoir and are the source for most of the springs which emerge in the center of the valley. Most of the private property is situated on the lower portions of these fans, which are good hay ground. The hay fields are generally watered from surface water diversions, but a few are watered by wells. Historically, flood irrigation was the most common irrigation method, but many ranchers are converting to sprinklers (USDI-BLM 1999b).

The upland vegetation in this valley can be broken into three general categories: Western Spruce/Fir forest and Grand Fir/ Douglas Fir forest at the higher elevations, and sagebrush steppe in the middle and lower elevations. The forest communities may include Grand fir, Douglas fir, larch, white pine, aspen, subalpine fir, and Engelmann spruce, along with numerous shrubs and herbaceous plants. The sagebrush communities include bluebunch wheatgrass and Wyoming big sage as primary components, with low sagebrush, atriplex, fescues, sand dropseed, other bluegrasses, and cryptogamic crusts (USDI-BLM 1999b).

The riparian communities are primarily willow and sedge/rush, with cottonwoods and aspen present in some areas. Other species present in the riparian areas include quackgrass, carpet bentgrass, smooth brome, orchardgrass, foxtail barley, Rocky Mountain iris, sweetclover, timothy, Kentucky bluegrass, dandelion, and whiteclover. Spotted knapweed and Canada thistle are common noxious weeds. Bull thistle is also present in many areas. In 1995 and 1998, two separate riparian surveys were conducted in the Pahsimeroi basin. A total of 32 streams were surveyed. The results of those surveys indicated that 16.4 miles (20.3%) of the surveyed reaches were functional, 61.8 miles (76.6%) were functional at risk, and 2.5 miles (3.1%) were considered non-functional (USDI-BLM 1999b).

Fish species that use the Pahsimeroi system include spring/summer chinook salmon, steelhead trout, rainbow trout, westslope cutthroat trout, bull trout, brook trout, mountain whitefish, redside shiner, sculpin, dace, longnose suckers, and northern pikeminnow. All but brook trout are indigenous. Irrigation practices in the valley have significantly affected the distribution of fish in the Pahsimeroi valley. Most of the mainstem Pahsimeroi is inaccessible to anadromous fish because of seasonal dewatering and areas where channels have been rerouted to facilitate water withdrawals. Only the first 10 diversions on the mainstem are screened; three more are accessible to anadromous fish and will be screened in the fall of 2002. At that time, several channels in the middle section of the river will be returned to their original channels, which will open up several miles of currently unaccessible mainstem habitat. Currently, none of the tributaries are connected to the mainstem during irrigation season (April through October) except in high water years. Several projects are being planned to improve irrigation efficiency, which will leave more water in the tributaries and possibly result in reconnection. Most tributaries and the upper portion of the Pahsimeroi are occupied by bull trout (USDI-BLM 1999b).

Middle Salmon-Panther Subbasin. The Middle Salmon-Panther Subbasin contains the North Fork and Panther Creek watersheds, along with the Lower Mainstem Salmon River. To facilitate adequate discussion of the baseline of these watersheds, they will be discussed separately in this Opinion.

North Fork Salmon River. The North Fork Salmon River enters the Salmon River at the town of North Fork, about 20 miles north of Salmon. The drainage consists of 214 square miles, and encompasses 230 miles of perennial streams. Of that total, 83% are located on lands administered by the SCNF, North Fork Ranger District. The remainder lie on privately owned land. Rosgen stream channel types are mostly A and B, with some C-type channels. Thirty percent of the watershed has a stream gradient of less than four percent, 38% is between four percent to 10%, and 32% has a gradient greater than 10% (USDA 1993b). The North Fork is currently used by chinook salmon and steelhead as spawning and rearing habitat.

Most of this watershed is comprised of steep, narrow, V-shaped canyons. The canyon walls generally have between a 60% to 90+ % slope. High elevations display evidence of strong glaciation, with cirques, cirque basins, headwalls, high peaks, and steep ridges. Many rocks in the area are sedimentary, although Challis volcanics and intrusive granite formations exist. Soils generally vary from shallow (less than 20 inches deep), to moderately deep (20 to 40 inches deep). In the valleys, they range from moderately deep to deep (greater than 40 inches deep). Soils derived from granitics and volcanics are highly erosive, while those of quartzite origin are low to moderately erosive (USDA 1993b).

Riparian vegetation in mesic draws is dominated by Engelmann spruce, ponderosa pine, and Douglas fir at lower elevations, and subalpine fir and spruce at higher sites. Some poplar and a few aspen stands are also present at lower elevations. Shrubs include dogwood, alder, chokecherry, rose, snowberry, and serviceberry. Upland vegetation varies by elevation and aspect. Lower elevations are typically occupied by bunchgrasses such as bluebunch wheatgrass and Idaho fescue. Associated shrubs and forbs include currant, rabbitbrush, sagebrush, and arrowleaf balsamroot. Middle elevations are typically covered in timber, mostly Douglas fir, lodgepole pine, subalpine fir, and Engelmann spruce. Associates include Idaho fescue, pinegrass, Oregon grape, sedges, heartleaf arnica, ninebark, chokecherry, white spirea, snowberry, mountain alder, menziesia, and huckleberry. Vegetation on the ridges is generally dominated by lodgepole pine, Douglas fir, Engelmann spruce, subalpine fir, and whitebark pine. Small open areas are common, which are covered with sedges and grasses (USDA 1993b).

<u>Panther Creek.</u> Panther Creek is a tributary to the Salmon River, located approximately 25 miles below North Fork, Idaho. This watershed covers 540 square miles and contains approximately 400 miles of perennial streams, of which 93% are on lands administered by the USFS and seven percent are on privately owned land. Stream channel types are mostly Rosgen type B and C, depending on gradient. Fifty-two percent of the watershed has a stream gradient of less than four percent, 41% has a gradient between four percent to 10%, and seven percent has a gradient greater than 10%. This watershed is comprised of steep, narrow, V-shaped drainages (USDA 1993a).

The soils in this watershed are derived from quartzite and granitic or volcanic parent materials. Erosion is very high on granite-based soils, low to moderate on soils decomposed from quartzite, and moderate to highly erosive on volcanic soils. Landslides and slumps are common, especially in the volcanic soils, which results in high rates of sediment input into streams. Rosgen stream channel types include A, B, and C-type channels (USDA 1993a).

Vegetation in this watershed varies by elevation and aspect. Upland vegetation in the lower part of the watershed is comprised of mixed conifer or sagebrush overstory with an understory of bluebunch wheatgrass, Idaho fescue, and mixed forbs. In the middle portion of the drainage (Trail Creek to Moyer Creek), upland vegetation is typical of the narrow, rocky canyon. Mixed conifers, mountain mahogany, and sagebrush are present, along with bunchgrasses and forbs. In the upper watershed, overstory vegetation is generally ponderosa pine with Idaho fescue, pinegrass or elk sedge, or Douglas fir with elk sedge or pinegrass.

Riparian vegetation in the lower valley consists of cottonwood, birch and alder, while vegetation in the middle valley is comprised of dogwood, alder, and birch. The upper riparian communities are either willow or Douglas fir. All zones have grass, sedge, and forb understories (USDA 2000).

Noxious weed species known to be present in this watershed include: spotted knapweed, diffuse knapweed, Russian knapweed, musk thistle, Canada thistle, Russian thistle, yellow toadflax, dalmation toadflax, leafy spurge, rush skeletonweed, and black henbane (USDA 1993a).

The SCNF administers 100 ongoing water withdrawals from public lands. The majority (80 claims) are for stockwater use, and the remainder are for domestic (7), irrigation (3), wildlife (4), pond stockwater (1), hot springs (1), and lake level maintenance (4) (USDA 1993a).

Mineral extraction has historically had significant effects on the Panther Creek watershed, and continues to affect fish habitat, primarily by the introduction of sediments and heavy metals into streams. Currently, Panther (Blackbird Creek to Salmon River), Bucktail (Headwaters to Big Deer Creek), Blackbird (Blackbird Reservoir to Panther Creek), and Big Deer (South Fork Big Deer Creek to Panther Creek) Creeks are listed on the 1998 DEQ 303(d) list for metals. Big Deer and Blackbird Creeks are also listed for sediment and pH (IDEQ 2001).

Major claims include the Musgrove, Blackbird, Blackpine, Panther Creek, Little Deer Creek, Ringbone, Haidee, Leesburg, Mayflower, Copper King, and Beartrack Mines. Most of these mines are no longer active and are in different stages of reclamation. However, the Blackbird Mine impacted 784 acres of land along the headwaters of Blackbird Creek. The main period of extraction was from 1949 to 1967, but mining activities occurred in the area as early as 1893. This mine extracted cobalt and copper sulfides. Within the impacted area exist several pits, waste rock piles, exploration roads, facilities, and tailings ponds. Noranda, the operator of this mine, has been actively reclaiming the site, but discharge of heavy metals and fine sediments continue to affect Blackbird Creek and Panther Creek (USDA 1993a). Another large mine that is currently in reclamation is the Beartrack Mine, located in upper Napias Creek. This was a cyanide heap leach gold mine that was active until March 2000 (USDA 1993a; USDA 2000).

During the summer of 2000, the Clear Creek Fire burned 170,686.6 acres of the Panther Creek watershed. This is approximately 50% of the total land area in the watershed. Fires burned at varying intensities in all parts of the watershed, with some areas only mildly impacted and others experiencing total stand-replacing events. Many of these burned areas are extremely susceptible to invasion by noxious weeds.

Lower Mainstem Salmon River. This watershed is similar to many of the other watersheds, with the exception that it includes the town of Salmon. Private land is situated adjacent to many of the waterways, and most of the occupied anadromous fish habitat. Primary impacts are agriculture, grazing, and roads. During the summer of 2000, the Clear Creek Fire burned 9,143.6 acres of this watershed. This is approximately 2.2% of the total land area in the watershed. Fires burned at varying intensities in western part of the watershed, with some areas only mildly impacted and others experiencing total stand-replacing events. Many of these burned areas are extremely susceptible to invasion by noxious weeds.

Lemhi River Subbasin. The Lemhi River watershed drains approximately 1,260 square miles between the Beaverhead Range of the Continental Divide on the north and east sides, and the Lemhi Range on the west. Elevations range from 4,100 feet at the confluence with the Salmon River one mile north of the town of Salmon, to 11,000 feet. Average annual precipitation ranges from 7 inches at lower elevations to 23 inches in the mountains. In general, most of the land immediately adjacent to the Lemhi River and it's major tributaries is in private ownership, BLM manages the land at the mid elevations, and the USFS manages the high elevation forests. State-owned lands are scattered throughout the basin (USDI-BLM 1999a).

Riparian vegetation consists primarily of willow, water birch, alder, red-osier dogwood, Wood's rose, chokecherry, gooseberry, current, aspen, and cottonwood, along with numerous sedges and rushes. Degraded areas are dominated by Kentucky bluegrass, clovers, and dandelion. Upland vegetation is primarily basin big sagebrush and bluebunch wheatgrass, although elevation, slope, aspect, and soil type affect the species composition. Other species present in the sagebrush steppe include Idaho fescue, mountain big sage, Wyoming sagebrush, three-tip sage, low sage, shadscale, and greasewood. High elevations consist of Douglas fir and lodgepole pine forests, with some Engelmann spruce and subalpine fir (USDI-BLM 1999a).

The Lemhi is a low gradient spring-fed system. The hydrology has been changed dramatically in the last 150 years, beginning with beaver and beaver dam removal, and continuing today with extensive irrigation withdrawals and channel alterations. All tributaries except Hayden Creek and Big Springs Creek are seasonally dewatered and no longer reach the mainstem Lemhi during the irrigation season (April to October) (USDI-BLM 1999a). Currently, fish passage through the lower portion of the river is impaired by low water conditions and structures associated with irrigation diversions. In 2001, the Idaho Office of Species Conservation, Idaho Department of Water Resources (IDWR), Idaho Department of Fish and Game (IDFG), NOAA Fisheries, FWS, The Lemhi Irrigation District, Water District 74, and the Upper Salmon Basin Watershed Project (USBWP) entered into an agreement (Lemhi Agreement) that among other things, provides stream flows sufficient for fish passage between the L6 diversion and the mouth of the Lemhi River. This is done through a combination of landowner agreements and annual water leases that is still being refined. The Lemhi Agreement also sets a time frame for development of a Habitat Conservation Plan for irrigation in the Lemhi River subbasin that addresses instream flow and other components of resident and anadromous fish habitat. In addition to the Lemhi Agreement, the Bureau of Reclamation is pursuing several diversion improvements to comply with the 2000 Federal Columbia River Power System Biological Opinion (NMFS 2000). Together, these activities will improve passage in the lower river, which has been limiting in the past. In addition, the Upper Salmon River Watershed Project is actively working with landowners to improve riparian habitat on private land.

3. Analysis of Effects of Proposed Action

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR 402.02). Direct effects occur at the project site and may extend upstream or downstream based on the potential for impairing essential elements of critical habitat. Indirect effects are defined in 50 CFR 402.02 as “those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.” They include the effects on listed species or critical habitat of future activities that are induced by the proposed action and that occur after the action is completed. “Interrelated actions are those that are part of a larger action and depend on the larger action for their justification” (50 CFR 403.02). “Interdependent actions are those that have no independent utility apart from the action under consideration” (50 CFR 402.02).

Effects of Proposed Action

In step 3 of NOAA Fisheries jeopardy/adverse modification analysis, the effects of proposed actions on listed salmon and steelhead are evaluated in the context of the status of the species and their habitats. To avoid jeopardy and destruction/adverse modification of critical habitat for listed salmon and steelhead, proposed actions generally must cause no more than minimal amounts of incidental take of the species, and also must restore, maintain, or at least not appreciably interfere with the recovery of the properly functioning condition of the various fish habitat elements within a watershed.

The BA provides a detailed analysis of the effects of the proposed action on Snake River spring/summer chinook salmon, sockeye salmon, and steelhead and on critical habitat for listed salmon in the action area. The effects analysis in this Opinion focuses on those elements of weed removal that have the potential to affect fish and their prey, or potential to affect hydrologic or riparian functions of the vegetative communities (using NOAA Fisheries’ matrices for waters in the Upper Salmon River subbasin [NMFS 1996]). The analysis is based primarily on toxic effects of herbicides on listed fish and their prey, and secondarily on the physical effects of weed removal. Toxic effects may potentially harm listed fish by killing them outright, through sublethal changes in behavior or physiology, or indirectly through a reduction in the availability of prey. Physical effects of weed removal could potentially affect riparian functions such as shade, cover, debris recruitment, and sediment filtering.

In the BA, a risk quotient was developed for each herbicide product that may be used to treat noxious weeds following the methodology of Urban and Cook (1986). The risk quotient (Table 6) provides a reference from which a possible worst-case situation involving lethal exposure can be viewed. A risk quotient greater than 10 indicates a low likelihood of lethal effects; a quotient between 1 and 10 indicates a moderate likelihood of lethal effects; and a risk quotient less than 1 indicates a high likelihood of lethal effects. The Urban and Cook (1986) method does not predict the likelihood of sublethal effects.

Presently, there are major gaps in the scientific understanding of how pesticides interact with the biology of migratory salmonids. This uncertainty falls into two categories. First, there is little data that documents the effects of the proposed herbicide products on aquatic ecosystems and the specific invertebrate prey of listed salmonids. Second, the scientific studies that have been conducted on fish are largely limited to measures of acute mortality - i.e., the concentrations at which short-term exposures to a pesticide will kill fish outright standard lethal concentration (LC50). In many cases, acute mortality data may not be appropriate for estimating whether a pesticide will have adverse, non-lethal effects on the essential behavior patterns of salmonids (e.g., feeding, spawning, or migration) (WSDOE 2001). Known effects of the proposed herbicides are summarized in Appendix B.

Sublethal effects of chemicals and pesticides do play a significant role in reducing the fitness of natural salmonid populations. Scholz et al (2000), and Moore and Waring (1996) indicate that environmentally relevant exposures to diazinon can disrupt olfactory capacity in the context of survival and reproductive success, both of which are key management considerations under the ESA (Scholz et al 2000).

Table 6. Aquatic Level of Concern Assessment for Herbicides used by the BLM.

Active Ingredient	Product Name	Typical Application Rate lb ai/ac [1]	Max Label Application Rate lb ai/ac [2]	EEC (ppm) [3]	Toxicity 96 hour LC50 (mg/L) [4]	Safety Factor 1/20 LC50 (mg/L)	Species Tested	Risk Quotient and Level of Concern [5]
Clopyralid	Transline	0.1-0.375	0.5	0.184	103	5.2	Rainbow Trout	28 Low
2,4-D amine	Weedar 64 or Weedestroy	0.5-1.5	3.0	1.103	250	12.5	Rainbow Trout	11 Low
Glyphosate	Rodeo	0.5-2.0	3.75	1.379	1000	50	Rainbow Trout	36 Low
Picloram[6]	Tordon 22K	0.125-0.5	1.0 [2]	0.368	19.3	0.965	Rainbow Trout	2 Moderate
Sulfometuron-methyl	Oust	0.25-0.75	2.0 oz	0.046	12.5	0.625	Rainbow Trout	161 Low

[1] Application rates are based upon typical and maximum label rates unless otherwise noted.

[2] Maximum application rate for plicoram is 1 lb per acre; Rates may be higher for smaller portions of the acre, but the total use on the acre cannot exceed 1 lb ai/ac/yr.

[3] Hazard Evaluation Division, Standard Evaluation Procedure – Ecological Risk Assessment (Urban and Cook, 1986).

[4] Rainbow Trout LC50 values from Herbicide Handbook, Seventh Edition (Ahrens 1994) and individual USFS Pesticide Fact Sheets and Risk Assessments. LC50 values are calculated using the formulated herbicide, not the active ingredient.

[5] The Risk Quotient and Level of Concern for a mixture of herbicides would reflect the values associated with the mixture's most toxic component. For example, the Level of Concern for a mixture of 2,4-D amine and Picloram would be Moderate, reflecting calculations based upon the higher toxicity of Picloram.

[6] Risk Quotient values for Picloram reflect the range of LC50 toxicity value of 5.5 to 19.3 mg/l identified by various observers. Level of Concern would be Moderate for LC50 values above 7.3 mg/l, including the midpoint value of 12.4 mg/l. Level of Concern would be high based upon LC50 values from 5.5 to 7.3 mg/l.

Likelihood That Listed Fish and Other Aquatic Organisms will be Exposed to Herbicides. The risk of adverse effects from the proposed action is largely dependent on the concentrations of herbicides that enter waters where listed fish occur. Herbicides can enter water through atmospheric deposition, spray drift, surface water runoff, groundwater contamination and intrusion, and direct application. The proposed action includes numerous "best management practices" (BMPs) intended to minimize or avoid water contamination from herbicides (See Section II B in this Opinion). The BMPs include stream and riparian buffers where chemical use is restricted or prohibited, limits on the amount of chemicals carried at a given time or applied to a given area, and rules governing application methods and timing. The BMPs and the likelihood of herbicides entering the water depend on the type of treatment and mode of transport.

Herbicide spraying can introduce chemicals directly into water through wind drift. Drift may occur during any spraying activity, including aerial applications, boom spraying, and hand spraying. Wind drift is more likely to occur during most aerial applications, and less likely to occur to a significant extent during ground-based spraying, unless sprays are directed into the air, or sprays are delivered in a fine mist. Water contamination from wind drift is primarily dependent upon the elevation of the spray nozzle, air movement, and droplet size. The smaller a droplet, the longer it stays aloft in the atmosphere, allowing it to travel farther. In still air, a droplet of pesticide the size of 100 microns (mist-size) takes 11 seconds to fall 10 feet. The same size droplet at a height of 10 feet travels 13.4 feet horizontally in a 1 mph wind, and 77 feet at 5 mph wind. Droplets released from spray equipment are not uniform in size, consequently, the indicated droplet size is the median diameter, with half the droplets smaller than the indicated diameter. During temperature inversions, little vertical air mixing occurs and drift can transport long distance. Low relative humidity and/or high temperature conditions will increase evaporation and the potential for drift. Since no aerial application is proposed, it is likely that spray drift could reach water only where chemicals are applied in riparian areas.

All of the herbicides used by the BLM can potentially enter streams through water transported by runoff, leaching, or percolation. Water contamination from rain events could transport chemicals to waterways, and convey them to chinook salmon or steelhead habitat. The adsorption of herbicides onto soils, stability, solubility, and toxicity of a chemical determine the extent to which it will migrate and adversely affect surface waters and groundwater (Spence et al 1996). For example, picloram is highly soluble and readily leaches through the soil. It is also resistant to biotic and abiotic degradation processes. It can also move from target plants, through roots, down into the soil, and into nearby non-target plants. Given this capability, a sufficient buffer zone is recommended to protect riparian vegetation when using picloram. Glyphosate and 2,4-D, though very soluble, bind well with organic material in soils and therefore are not leached easily. All four herbicides are susceptible to transport in surface runoff, especially if applications are followed immediately by high rainfall events. However, data limitations make it difficult to precisely estimate the degree of ecological risk.

The potential concentrations of chemicals in the water, as a result of contamination from the proposed action, are not known. The BA provides rough estimates of the amount of chemicals expected to reach the water, based on modeling or monitoring reported in published literature. Indicators of potential exposure are characterized by available information on factors that determine the likelihood of the chemicals reaching water. Indicators include physical properties of the chemicals; soil properties such as the amount of organic material, soil depth, soil type, pH, water content, and oxygen content; and environmental conditions such as temperature, and rainfall amounts. An environment containing dry soil with low microbial presence, which receives periodic high-intensity rainfall events, will be very susceptible to both leaching and surface runoff of picloram. This will also be true to a lesser extent with 2,4-D and glyphosate.

Post-application direct effects may occur in association with rain events that may transport the chemicals to waterways, which will convey them downstream to sockeye and chinook salmon or steelhead habitats. The adsorption potential, stability, solubility, and toxicity of a chemical determines the extent to which it will migrate and adversely affect surface waters and groundwater (Spence et al 1996). Picloram and sulfometuron methyl are highly soluble and are readily leached through the soil. Picloram, unlike sulfometuron methyl, is resistant to biotic and abiotic degradation processes. It can also move from target plants, through roots, down into the soil, and into nearby non-target plants. Given this capability, picloram is capable of killing non-target riparian plants if used near riparian areas. Glyphosate, clopyralid, and 2,4-D, though soluble, bind well with organic material in soils and therefore are not leached easily. Their solubility lends all herbicides susceptible to transport in surface runoff, especially if applications are followed immediately with high rainfall events.

Likelihood of Direct Effects. Most direct effects of herbicides on listed salmon and steelhead are likely to be from sublethal effects, rather than outright mortality from herbicide exposure. Sublethal effects are considered under the ESA to constitute "take," if the sublethal effects "harm" listed fish. NOAA Fisheries defines harm as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR 222.102). These behavioral patterns, and their underlying physiological processes are typically reported for individual test animals. However, the ecological significance of sublethal toxicological effects depends on the degree to which they influence behavior that is essential to the viability and genetic integrity of wild populations. It is important to note that many sublethal toxicological endpoints or biomarkers may harm fish in ways that are not readily apparent. When small changes in the health or performance of individual fish are observed (e.g. a small percentage change in the activity of a certain enzyme, an increase in oxygen consumption, the formation of pre-neoplastic hepatic lesions, etc.), it may not be possible to infer a significant loss of essential behavior patterns of fish in the wild, even in circumstances where a significant loss could occur.

An analysis of the direct impacts of herbicides on salmonids should relate the site-specific exposure conditions (i.e., expected environmental concentration, bioavailability, and exposure duration) to the known or suspected impacts of the chemical on the health of exposed fish. Where possible, such analyses should consider: (1) The life history stage (and any associated vulnerabilities) of the exposed salmonid; (2) the known or suspected mechanism of toxicity for the active ingredient (or adjuvant) in question; (3) local environmental conditions that may modify the relative toxicity of the contaminant; and (4) the possibility of additive or synergistic interactions with other chemicals that may enter surface waters as a result of parallel or upstream land use activities.

A probabilistic risk assessment (PRA), based on the relationship between the likelihood of exposure and the magnitude of effect is used to evaluate the proposed action. Traditionally, a PRA incorporates data from a LC50 exposure study as well as chronic exposure data to predict the sensitivity of an organism to the pesticide or chemical. The lethality endpoint has little predictive value for assessing whether real world pesticide exposure will cause sublethal neurological and behavioral disorders in wild salmon (Scholz et. al 2000), but in most cases, the LC50 is the only toxicity data available. Although little information is available on the sublethal effects of the herbicides on listed fish, there can be subtle sublethal effects that can potentially affect the survival or reproduction of large population segments. For example, Scholz et al (2000), and Moore and Waring (1996) indicate that environmentally relevant exposures to diazinon can disrupt olfactory capacity in the context of survival and reproductive success of chinook salmon, both of which are key management considerations under the ESA (Scholz et al 2000). The likelihood of similar effects with the chemicals proposed for use is unknown.

Based on the analysis provided in the BA, and available literature, it appears unlikely that the proposed herbicide use would cause outright fish kills at concentrations of the active ingredients likely to occur in water from the proposed action, except for circumstances where high herbicide concentrations result from heavy rainfall shortly after herbicides are applied, or as a result of an accidental spill. All LC50 concentrations for salmonids, for the active ingredients in the herbicides proposed for use, and reported in the literature cited in the BA and in this Opinion, are above 1 milligram per liter (mg/L) (see Appendix B), while environmental concentrations would typically be at least 1 to 2 orders of magnitude lower. While the active ingredients appear to pose a low risk of mortality, the likelihood of outright mortality of listed fish from exposure to product formulations that include unknown adjuvants is virtually unknown due to the paucity of information available.

Although lethal effects are not expected to occur under most circumstances, listed fish are likely to be exposed to herbicide concentrations where sublethal effects could occur. Potential sublethal effects, such as those leading to a shortened lifespan, reduced reproductive output, other types of "ecological death" (e.g. Kruzynski et al 1994; Kruzynski and Birtwell 1994) or other deleterious biological outcomes is a threat to listed species from the proposed action. The toxicological endpoints identified below are possible for a variety of pesticides and are generally considered to be important for the fitness of salmonids and other fish species. They include:

- Direct mortality at any life history stage.
- An increase or decrease in growth.
- Changes in reproductive behavior.
- A reduction in the number of eggs produced, eggs fertilized, or eggs hatched.
- Developmental abnormalities, including behavioral deficits or physical deformities.
- Reduced ability to osmoregulate or adapt to salinity gradients.
- Reduced ability to tolerate shifts in other environmental variables (*e.g*. temperature or increased stress).
- An increased susceptibility to disease.
- An increased susceptibility to predation.
- Changes in migratory behavior.

Most of these endpoints (above) have not been investigated for the herbicides in the proposed action, however some limited data are available. Information on sublethal effects of glyphosate is available for many of the above endpoints, and of those reported, glyphosate appears to carry a low risk for sublethal effects. Sulfometuron-methyl had no effect on hatchability, growth, or survival of flathead minnow eggs or fry, at concentrations of 1.17 mg active ingredient per liter (a.i./L) (SERA 1998a). Potential chronic effects of sulfometuron methyl at concentrations between 1.17 mg a.i./L and 100 mg a.i./L cannot be dismissed but long-term exposure to greater than 1 mg a.i./L sulfometuron methyl is unlikely (SERA 1998a). Woodward (1979) found that picloram concentrations greater than 0.61 mg/L decreased growth of cutthroat trout, and a similar finding was reported by Mayes (1984). Maximum exposure concentrations not affecting survival and growth of cutthroat trout ranged from 290 to 48 micrograms per liter (ug/l) in Woodward's (1979) study. Tests with the early life-stages of rainbow trout showed that picloram concentrations of 0.9 parts per million (ppm) reduced the length and weight of rainbow trout larvae, and concentrations of 2 ppm reduced survival of the larval fish (Mayes et al 1987). Woodward (1976), in a study of lake trout, found that picloram reduced fry survival, weight, and length at concentrations of 0.04 ppm, and that the rate of yolk sac absorption and growth of lake trout fry was reduced in flow-through tests at concentrations as low as 0.35 mg/l. Yearling coho salmon exposed to 5 ppm of picloram for 6 days suffered "extensive degenerative changes" in the liver and wrinkling of cells in the gills (USEPA 1979).

Little et al (1990) examined behavior of rainbow trout exposed for 96 hours to sublethal concentrations of 2,4-D amine, and observed inhibited spontaneous swimming activity and swimming stamina. Changes in schooling behavior and red blood cells, reduced growth, impaired ability to capture prey, and physiological stress were reported for 2-4,D (Gomez et al 1998; Cox 1999). The 2,4-D can also combine with other pesticides and have a synergistic effect, resulting in increased toxicity. Combining 2,4-D with picloram damages the cells of catfish (*Ictalurus spp*) gills, although neither individual pesticide has been found to cause this damage (Cox 1999).

The consequences of these sublethal effects are uncertain, but the loss of physiological or behavioral functions can adversely affect the survival, reproductive success, or migratory behavior of individual fish. Such effects, in turn, can be expected to reduce the viability of wild populations. Additional endpoints could also be significant if a clear relationship is established between the observed impairment and the "essential biological requirements" of salmonids (i.e. the likelihood that the exposed animal will survive the various phases of its life cycle and return to its natal river system to spawn).

Likelihood of Indirect Effects. Indirect effects of pesticides can occur through their effects on the aquatic environment and non-target species. The likelihood of adverse indirect effects is dependent on environmental concentrations, bioavailability of the chemical, and persistence of the herbicide in salmon habitat. For most pesticides, including the chemicals in the proposed action, there is little information available on environmental effects, such as negative impacts on primary production, nutrient dynamics, or the trophic structure of macroinvertebrate communities. Most available information on potential environmental effects must be inferred from laboratory assays; however, a few observations of environmental effects are reported in the literature. Due to the paucity of information, there are uncertainties associated with the following factors: (1) The fate of herbicides in streams; (2) the resiliency and recovery of aquatic communities; (3) the site-specific foraging habits of salmonids and the vulnerability of key prey taxa; (4) the effects of pesticide mixtures that include adjuvants or other ingredients that may affect species differently than the active ingredient; and (5) the mitigating or exacerbating effects of local environmental conditions. Where uncertainties cannot be resolved using the best available scientific literature, the benefit of the doubt should be given to the threatened or endangered species in question (H.R. Conf. Rep. No. 697, 96th Cong., 2nd Sess. 12 [1979]).

It is becoming increasingly evident that indirect effects of contaminants on ecosystem structure and function are a key factor in determining a toxicant's cumulative risk to aquatic organisms (Preston 2002). Moreover, aquatic plants and macroinvertebrates are generally more sensitive than fish to the acutely toxic effects of herbicides. Therefore, chemicals can potentially impact the structure of aquatic communities at concentrations that fall below the threshold for direct impairment in salmonids. The integrity of the aquatic food chain is an "essential biological requirement" for salmonids, and the possibility that herbicide applications will limit the productivity of streams and rivers should be considered in an adverse effects analysis.

The potential effects of herbicides on prey species for salmonids are also an important concern. Juvenile Pacific salmon feed on a diverse array of aquatic macroinvertebrates (i.e. larger than 595 microns in their later instars or mature forms [Cederholm et al 2000]). Terrestrial insects, aquatic insects, and crustaceans comprise the large majority of the diets of fry and parr in all salmon species (Higgs et al 1995). Prominent taxonomic groups include Chironomidae (midges), Ephemeroptera (mayflies), Plecoptera (stoneflies), Tricoptera (caddisflies), and Simuliidae (blackfly larvae) as well as amphipods, harpacticoid copepods, and daphniids. Chironomids in particular are an important component of the diet of nearly all freshwater salmon fry (Higgs et al 1995). In general, insects and crustaceans are more acutely sensitive to the toxic effects of environmental contaminants than fish or other vertebrates. However, with a few exceptions (e.g. daphniids), the impacts of pesticides on salmonid prey taxa have not been widely investigated. Where acute toxicity for salmonid prey species are available, however, they should be used to estimate the potential impacts of herbicide applications on the aquatic food chain.

Human activities that modify the physical or chemical characteristics of streams often lead to changes in the trophic system that ultimately reduce salmonid productivity (Bisson and Bilby 1998). In the case of herbicides, a primary concern is the potential for impacts on benthic algae. Benthic algae are important primary producers in aquatic habitats, and are thought to be the principal source of energy in many mid-sized streams (Minshall 1978; Vannote et al 1980; Murphy 1998). Herbicides can cause significant shifts in the composition of benthic algal communities at concentrations in the low parts per billion (Hoagland et al 1996). Moreover, based on the data available, herbicides have a high potential to elicit significant effects on aquatic microorganisms at environmentally relevant concentrations (DeLorenzo et al 2001). In many cases, however, the acute sensitivities of algal species to herbicides are not known. In addition, Hoagland et al (1996) identify key uncertainties in the following areas: (1) The importance of environmental modifying factors such as light, temperature, pH, and nutrients, (2) interactive effects of herbicides where they occur as mixtures, (3) indirect community-level effects, (4) specific modes of action, (5) mechanisms of community and species recovery, and (6) mechanisms of tolerance by some taxa to some chemicals. Herbicide applications have the potential to impair autochthonous production and, by extension, undermine the trophic support for stream ecosystems. However, existing data gaps make it difficult to precisely estimate the degree of ecological risk, and limited information is available on the ecological effects of the chemicals in the proposed action.

The growth of salmonids in freshwater systems is largely determined by the availability of prey (Chapman 1966; Mundie 1974). For example, supplementation studies (Mason 1976) have shown a clear relationship between food abundance and the growth rate and biomass yield or productivity of juveniles in streams. Therefore, herbicide applications that kill or otherwise reduce the abundance of macroinvertebrates in streams can also reduce the energetic efficiency for growth in salmonids. Less food can also induce density-dependent effects, that is, competition among foragers can be expected to increase as prey resources are reduced (Ricker 1976). These considerations are important because juvenile growth is a critical determinant of freshwater and marine survival (Higgs et al 1995). For example, a recent study on size-selective mortality in chinook salmon from the Snake River (Zabel and Williams 2002) found that naturally reared wild fish did not return to spawn if they were below a certain size threshold when they migrated to the ocean. There are two primary reasons mortality is higher among smaller salmonids. First, fish that have a slower rate of growth suffer size-selective predation during their first year in the marine environment (Parker 1971; Healy 1982; Holtby et al 1990). Growth-related mortality occurs late in the first marine year and may determine, in part, the strength of the year class (Beamish and Mahnken 2001). Second, salmon that grow more slowly may be more vulnerable to starvation or exhaustion (Sogard 1997).

Physical Effects of Herbicides on Watershed and Stream Functions. The use of herbicides can affect watershed or stream functions through the removal of vegetation and exposing bare soil. For boom spraying, and hand and spot applications, the potential for significant increases in erosion or water yield is limited because treatments would consist of small, scattered areas, and vegetation would typically be reestablished within a few months to a year. The proposed no-spray buffer strips and other BMPs should minimize the effects of drift, chemical leaching, or other effects of weed spraying on riparian vegetation.

No measurable adverse effects to peak/base flow, water yield, or sediment yield are likely to occur from implementation of noxious weed control and rehabilitation measures. Removal of solid stands of noxious weed vegetation by chemical treatment may result in short-term, negligible increases in surface erosion that would diminish as desired vegetation re-occupies the treated site. Only ground based spot/selective spraying will be authorized within riparian areas or within 100 feet of live water (whichever is larger). This will significantly reduce risks associated with spraying of non-target riparian vegetation. Noxious weed control measures will reduce weed competition with native riparian species and other upland species. Herbicide spraying in riparian areas will be minimal and will primarily be associated with spot spraying along road right-of-ways, and spot spraying of small patches of noxious weeds or individual plants.

Summary of Effects. The proposed action could potentially affect listed salmon and steelhead through lethal or sublethal chemical effects on listed fish, through alteration of the food web from toxic chemical effects, loss of desired riparian vegetation from contact with herbicides, or through restoration of native vegetation or more naturally-functioning watershed processes that are impaired by infestations of invasive weeds.

The risk of harm to listed salmon and steelhead from contact with herbicides is a function of chemical concentration to which listed fish are exposed, and the toxicity of the chemical. Available literature cited above indicates that expected levels of exposure to the herbicides are likely to be well below levels where the herbicides cause direct mortality of listed salmon or steelhead once they matured beyond the fry stage. This conclusion is based on the fact that reported thresholds for mortality are at least 1 to 2 orders of magnitude higher than likely herbicide concentrations in water resulting from the proposed action. Salmonid eggs and fry appear to be more sensitive to toxic effects than older life stages, and reported concentrations where mortality was observed in these life stages approach the range of concentrations that might occur in the action area. Herbicide spraying in the vicinity of steelhead or salmon eggs or fry, could result in direct mortality if chemicals are sprayed into the water, or if rainfall occurs shortly after application. The relatively small amount of area treated within a given watershed, use of BMPs to reduce the likelihood of exposure, and the dilute concentrations proposed for use reduce the probability that direct mortality would occur from chemical exposure.

Although outright mortality from herbicide exposure is not expected to occur, adverse effects reported in sublethal assays include reductions in reproductive success, weight loss, physiological effects (endocrine system, blood chemistry, liver function, etc.), and reductions in growth, prey capture ability, and swimming ability, all of which are associated with reduced survival. Information available on sublethal effects is incomplete, and few herbicide formulations have been thoroughly tested for sublethal effects on salmon or steelhead. Consequently, the extent of sublethal effects could be much greater than indicated by available information. Harm to listed fish from effects of chemicals on food webs is also possible, but difficult to quantify due to the paucity of information.

Given the presence of listed fish in the action area, the range of soil properties in the action area, chemicals proposed for use, rainfall patterns, and proposed spray activities, it is likely that circumstances will arise where herbicide concentrations in water will reach levels where delayed mortality or reduced reproductive success would occur. Such circumstances would arise in isolated instances when various combinations of factors occur, such as: (1) use of chemicals that persist in the environment for several months or longer; (2) conditions that allow chemicals to move rapidly through soils; (3) when precipitation occurs before the chemicals break down, bind to soil particles, or get taken up by plants; (4) where listed fish or redds are in the vicinity of a spray site; or (5) where the amount of chemical applied to an area is great enough to reach concentrations that could harm listed fish. Specific locations where harm is likely to occur from the proposed action cannot be identified at this time, since most of the above factors will not be known until spray sites are selected.

Changes in vegetation from weed spraying or other control methods can beneficially or adversely affect riparian and watershed functions. Adverse effects have been reported in instances where herbicides killed non-target plants, particularly riparian trees killed as a result of spray drift or uptake by roots. Beneficial effects to aquatic systems from noxious weed control are not well-documented, but could conceivably occur in circumstances where weed treatments kill exotic plants that would otherwise create a disclimax riparian plant community or displace native plants that provide shade, cover, habitat complexity, streambank stability, or recruitment of terrestrial invertebrate prey. In some drier portions of the action area, exotic weeds have almost completely displaced native grasses and forbs. In these areas, fire frequency, fire behavior, ground cover characteristics, and watershed hydrology are all likely to be altered by weeds, and effective weed control could reduce or eliminate these adverse effects.

Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Other activities within the watershed have the potential to impact fish and habitat within the action area. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being reviewed through separate section 7 consultation processes. Past Federal actions have already been added to the environmental baseline in the action area.

Land use in the action area includes agriculture, timber harvest, roads, residential housing, recreation, mining, and livestock grazing. Water diversions for irrigation are common. Current levels of these uses are likely to continue at similar levels, but detailed information on non-Federal activities in the action area are not available.

Livestock grazing may partially thwart weed control efforts. Cattle can spread weeds through their droppings, and create conditions that increase the likelihood that invasive weeds will out-compete native plants. Riparian cattle grazing on non-Federal lands is likely to cumulatively affect water temperature and water quality in portions of the action area.

Streamflows in portions of the action area are greatly reduced by water diversions that originate on private lands (also on Federal lands, but these effects are part of the baseline). Reduced streamflows where water is diverted could appreciably increase the likelihood of reaching herbicide concentrations where adverse effects would occur due to reduced water volume. Water returning to streams from irrigation ditches is also likely to contain contaminants. Any herbicide contamination that occurs from the proposed action could potentially combine with effects of low water volume, contamination from return flows and non-Federal herbicide use to create a mixture of pollutants that are harmful to listed fish or their prey. The likelihood of adverse effects and the magnitude of any such effects from a combination of pollutants is unknown. However, fish stressed by elevated sediment and temperatures (under the baseline), and low flows are more likely to susceptible to toxic effects of herbicides and other pollutants that might result from the combined effect of Federal and non-Federal actions in the action area.

Ongoing herbicide application programs implemented by state, county and private land managers/owners that have been conducted within the proposed action area are likely to continue. The full scope of these programs is not known to the BLM, and changes annually. The Idaho Transportation Department has in the past and continues to conduct an active spray program for controlling noxious weeds, and the IDFG uses herbicides to treat weeds on wildlife management areas. The cities, state, and counties also have active herbicide application programs on road right-of-ways. NOAA Fisheries staff have observed county road crews spraying herbicides from a raft on streambank vegetation and directly into the river near the town of Challis and in other parts of Idaho. The amount of herbicide contamination in water from Federal, state, and county agencies and private landowners in the action area is unknown.

4. Conclusion

The final step in NOAA Fisheries' analysis to determine jeopardy or adverse modification is to determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival in the wild or adversely modify critical habitat. NOAA Fisheries has determined that, when the effects of the proposed action are added to the environmental baseline and cumulative effects occurring in the action area, given the status of the stocks and condition of critical habitat, the action is not likely to jeopardize the continued existence of the two listed ESUs considered in this Opinion. Further, NOAA Fisheries concludes that the subject action would not cause adverse modification or destruction of designated critical habitats for listed ESUs of spring/summer chinook salmon considered in this Opinion.

These conclusions are based on the following considerations:

(1) The proposed action is not likely to impair physical habitat conditions or processes, since the majority of weed treatment sites are dispersed areas that would not be large enough to have any discernable effect on stream functions, and in instances where weed control activities occur in riparian areas or over large contiguous blocks of land, the activities are restricted by BMPs that prevent or minimize adverse effects.

(2) The proposed action is likely to impair water quality where herbicides enter the stream, however, such impairments are expected to occur in isolated cases, and be of short duration (e.g. spikes in concentration following a rainfall, or occasional chemical drift into water that is quickly diluted).

(3) The herbicides are unlikely to reach concentrations that cause direct mortality of listed salmon and steelhead, or their prey.

(4) Although toxicity of the herbicides may be underestimated due to gaps in the information available on toxic effects, gross errors in the effects analysis are not anticipated because the area where adverse effects could occur is a small percentage of any given subbasin, and relatively small amounts herbicides will be applied.

(5) The proposed action will not reduce the survival of listed Snake River salmon or steelhead because instances where listed fish are likely to be killed or harmed are expected to be uncommon. Under most circumstances, the BMPs in the proposed action are expected to largely prevent herbicides from reaching water concentrations where listed fish would be killed or harmed by the chemicals.

In reaching these determinations, NOAA Fisheries used the best scientific and commercial data available.

5. Conservation Recommendations

Conservation recommendations are defined as suggestions of NOAA Fisheries "regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information" (50 CFR 402.02). Section 7 (a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. NOAA Fisheries believes the conservation recommendations listed below are consistent with these obligations, and therefore should be implemented by the BLM.

a. The BLM should use herbicides with least toxicity to listed fish and other non-target organisms whenever possible.

b. The BLM should investigate the utility of alternative forms of weed control that do not involve the use of chemicals toxic to aquatic organisms. Examples of alternatives include substitution of vinegar or acetic acid formulations for spot-spraying weeds, and use of steam or other heat-killing methods.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we recommend NOAA Fisheries is notified of the implementation of any conservation recommendations.

6. Reinitiation of Consultation

This concludes formal consultation under the ESA on the BLM Salmon and Challis Field Offices' 2002 Noxious Weed Control Program as outlined in the BA submitted on May 28, 2002. This consultation is only valid for applications occurring prior to December 31, 2002. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; (4) a new species is listed or critical habitat is designated that may be affected by the action; or (5) a consultation is completed with EPA on pesticide registrations that would affect application rates or locations, or use. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

B. Incidental Take Statement

Sections 4 (d) and 9 of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined in 50 C.F.R. 222.102 as "an act that may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering." Harass is defined as actions that create the likelihood of injuring listed species to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is take of listed species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

1. Amount or Extent of Take

The proposed action is reasonably certain to result in incidental take of Snake River spring/summer chinook salmon and Snake River steelhead. NOAA Fisheries is reasonably certain the incidental take described here will occur because: (1) recent and historical surveys indicate the listed species are known to occur in the action area; and (2) the proposed action would adversely affect essential features of critical habitat that would in turn reduce the survival of the listed species for feeding, breeding, or sheltering.

Despite the use of best scientific and commercial data available, NOAA Fisheries cannot quantify a specific amount of incidental take or individual fish or incubating eggs for this action. Instead, the extent of take is anticipated to result from: (1) lethal or sublethal exposure to herbicides that kills or harms listed fish, respectively, as a result of accidental spills; failure of BMPs to keep chemical concentrations below expected levels; unexpected toxic effects that have not been reported in the scientific literature; or additive or synergistic effects of herbicides from multiple sources in the action area; and (2) indirect effects on the prey base. The amount of this expected take is unquantifiable because it depends on the specific locations where treatments will occur, which are not known at this time, and on unpredictable factors such as outcomes that differ from "typical" results, the number of fish present when the activities occur, or the future use of chemicals by non-Federal parties.

In circumstances where the amount of take cannot be quantified, the extent of incidental take is described (50 CFR 402.14 [i]). The extent of take in the action area is limited to the amount caused by herbicide applications on a maximum of 50.78 riparian acres in the Upper Salmon River subbasin, distributed across the four watersheds identified in Table 1 and Appendix A, and NOAA Fisheries anticipates that take will not occur in all the riparian treatment areas.

In this Opinion, NOAA Fisheries determined that this level of anticipated take is not likely to result in jeopardy to the species or in the destruction or adverse modification of critical habitat.

2. Reasonable and Prudent Measures

Reasonable and Prudent Measures are non-discretionary measures to minimize take, that are not already part of the description of the proposed action. They must be implemented as binding conditions for the exemption in section 7(a)(2) to apply. The BLM has the continuing duty to regulate the activities covered in this incidental take statement. If the BLM fails to require the applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. NOAA Fisheries believes that activities carried out in a manner consistent with these reasonable and prudent measures, except those otherwise identified, will not necessitate further site-specific consultation. Activities which do not comply with all relevant reasonable and prudent measures will require further consultation.

NOAA Fisheries believes that the following reasonable and prudent measures are necessary and appropriate to minimize take of listed fish resulting from implementation of the action. These reasonable and prudent measures would also minimize adverse effects on designated critical habitat.

a. Minimize the likelihood of incidental take associated with herbicide application by implementing BMPs to limit exposure of listed fish to the chemicals.

b. The BLM shall monitor and report on the effectiveness of the proposed conservation measures in minimizing incidental take, and report this information to NOAA Fisheries.

c. The BLM shall report to NOAA Fisheries the activities actually completed during the 2002 season.

3. Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the BLM must comply with the following terms and conditions, which implement the reasonable and prudent measures described above for each category of activity. These terms and conditions are non-discretionary.

1. To implement Reasonable and Prudent Measure #a, above, the BLM shall:

    a. Implement all BMPs described in the Proposed Action section of this Opinion.

    b. Review the BLM spill response plan with the contracted applicator prior to commencing herbicide application operations.

c. Inform NOAA Fisheries of the planned schedule for herbicide application to allow NOAA Fisheries to observe any chemical application operation. Contact: NOAA Fisheries, Salmon Field Office, ATTN: Jan Pisano, 100 Courthouse Drive, Salmon, Idaho, 83467; or call (208)756-6478. Contact should be made at least one week prior to commencing initial application.

d. Ensure all chemical storage, chemical mixing, and post-application equipment cleaning is completed in such a manner as to prevent the potential contamination of any Riparian Habitat Conservation Area (RHCA), perennial or intermittent waterway, unprotected ephemeral waterway, or wetland.

e. Within 100 feet of active stream channels, truck and ATV mounted spray equipment may be used when the equipment is computer metered and care is taken to avoid the introduction of herbicide into water. This may require the use of the attached hand sprayers rather than the boomless nozzles. Herbicide mixtures will be monitored to ensure that picloram is applied consistent with the guidelines in Table 3 of this Opinion.

f. Use only Rodeo and or Weedar/Weedestroy within 15 feet of stream channels, and within this zone minimize spraying. Other herbicide application techniques such as wiping, wicking, painting, etc. will be used when possible and practical.

g. Delay treatment if precipitation is occurring or is likely to occur within 24 hours of scheduled application.

h. Have a licensed/certified herbicide applicator overseeing all spray projects.

i. Treat only the minimum area necessary for the control of noxious weeds.

j. Ensure that all equipment used for transportation, storage, or application of chemicals be maintained in a leakproof condition. No terrestrial equipment (ATV's, trucks, backpack sprayers, etc.) will be loaded, unloaded, or filled within 100 feet of any perennial or intermittent stream or water body.

k. If it is necessary to use boats to reach a treatment area, the only mixed herbicides to be transported over water will be those that do not contain picloram. Picloram will only be transported in the original manufacturer's container, and will be mixed at least 100 feet from live or seasonal waterways. Extreme caution will be used while loading and unloading herbicides and spray equipment to minimize the potential for contamination of the water. When possible, the boat will be grounded before loading or unloading at the destination, and will be loaded or unloaded at the origin while still on the trailer and at least 100 feet away from any perennial or intermittent waterway.

l. No ester formulations of 2,4-D will be used.

2. To implement Reasonable and Prudent Measure #b, above, the BLM shall:

   a. Specify in a monitoring plan the sampling design and methodology used to assess effects of the program on native herbaceous or woody perennial riparian vegetation, and effectiveness of reseeding or planting of woody species. This term and condition would provide details that are not specified in the BA regarding monitoring that is currently done to determine treatment effectiveness and effects to non-target species.

   b. Non-target plant mortality in riparian areas will be monitored to determine if mortality of non-target plants is affecting riparian functions.

   c. Spray cards, dye or other type of indicator to monitor chemical drift will be used at the waters edge on a small sample (no less than five sites) of riparian treatment areas. These indicators will provide visual verification that application methods are minimizing risk to listed fish species. Findings from these indicators will be included with the annual monitoring results.

   d. Monitoring results will be reported to NOAA Fisheries (see Item 1.c. above for contact information) after the field season and prior to 2003 weed control activities if similar activities are proposed in 2003.

   e. If a listed species specimen is found dead, injured, or sick, as a possible result of the proposed action or other unnatural cause, initial notification must be made to the National Marine Fisheries Service Law Enforcement Office, in the Vancouver Field Office, 600 Maritime, Suite 130, Vancouver, Washington 98661; or call: 360.418.4246. Care should be taken in handling sick or injured specimens to ensure effective treatment and care. Dead specimens should be handled to preserve biological material in the best possible state for later analysis of cause of death. With the care of sick or injured listed species or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed.

3. To implement Reasonable and Prudent Measure #c, above, the BLM shall:

   a. Report to NOAA Fisheries the actual number of acres treated, the chemicals used, application method, and location of treatment sites.

III. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

A. Background

The objective of the EFH consultation is to determine whether the proposed action may adversely affect designated EFH for relevant species, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH resulting from the proposed action.

B. Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH.

The EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of essential fish habitat: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50CFR600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;

- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;

- Federal agencies shall within 30 days after receiving conservation recommendations from NOAA Fisheries provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

C. Identification of EFH

The Pacific Fisheries Management Council (PFMC) has designated EFH for Federally-managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km)(PFMC 1998b; PFMC 1998a). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC 1999).

In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border.

Detailed descriptions and identifications of EFH for the groundfish species are found in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to The Pacific Coast Groundfish Management Plan (PFMC 1998a) and the NOAA Fisheries Essential Fish Habitat for West Coast Groundfish Appendix (Casillas et al 1998). Detailed descriptions and identifications of EFH for the coastal pelagic species are found in Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (PFMC 1998b). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the potential adverse effects to these species' EFH from the proposed action is based on this information.

D. Proposed Actions

The proposed action is detailed above in section I.B. The action area includes habitat located in the Upper Salmon River subbasin. This area has been designated as EFH for various life stages of Snake River spring/summer chinook salmon.

E. Effects of Proposed Action

As described in detail in section II.A.3, the proposed activities may result in detrimental short- and long-term adverse effects to a variety of habitat parameters. These impacts include changes in water quality, food availability, or riparian vegetation.

F. Conclusion

NOAA Fisheries has determined that the proposed action may adversely affect the EFH for Snake River spring/summer chinook salmon.

G. EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations for any Federal or state agency action that would adversely affect EFH. The conservation measures proposed for the project by the BLM, all Conservation Recommendations outlined above in section II.A.5 and all of the Reasonable and Prudent Measures and the Terms and Conditions contained in sections II.B.2 and II.B.3 are applicable to EFH. Therefore, NOAA Fisheries incorporates each of those measures here as EFH recommendations.

H. Statutory Response Requirement

Please note that the MSA (section 305(b)) and 50 CFR 600.920(j) requires the Federal agency to provide a written response to NOAA Fisheries after receiving EFH conservation recommendations within 30 days of its receipt of this letter. This response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the adverse impacts of the activity on EFH. If the response is inconsistent with a conservation recommendation from NOAA Fisheries, the agency must explain its reasons for not following the recommendation.

I. Consultation Renewal

The BLM must reinitiate EFH consultation with NOAA Fisheries if the action is substantially revised or new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920).

IV. REFERENCES

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APPENDIX A

2002 Herbicide Application on Lands Administered by the BLM Salmon and Challis Field Offices’

Lemhi River Subbasin - 17060204

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Yearian Crk	170602040602; 170602040603	1.0	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	July 2002	none
Cow Crk summit & 2 tracks	170602040602; 170602040603	.5	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	July 2002	none
Reese Creek	170602040602; 170602040603	4.0	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Yearian Crk 2 tracks	170602040602; 170602040603	2.2	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Peterson Creek	170602040701; 170602040603	.56	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Agency Crk to Lemhi Pass	170602040401	3.0	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Agency/Cow creek	170602040401	.44	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none

Drainage Name/code and Description	6^{th} Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Ramsey Mtn Rd	170602040401; 170602040501	2.3	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Yearian Crk	170602040401; 170602040601; 170602040602	.50	.10	ATV	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	none
Ramsey Mtn area 2tracks	170602040401; 170602040501; 170602040601	1.9	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Ramsey Mtn, Lemhi side	170602040501; 170602040601	3.3	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Agency Crk. to Cow Creek	170602040401	.60	.50	ATV	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing
McDevitt Creek	170602040301; 170602040502	.40	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	April/ May 2002	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Pattee Creek	170602040303	3.55	.25	backpack	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing BT - rearing, migration
Alkali Flats/Warm Sprs Wood Rd	170602040301; 170602040303	2.0	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Pattee Creek	170602040301; 170602040401	.10	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Agency Crk to Flume	170602040401	2.5	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
East Bohannon	170602040104	3.6	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
West Fork Wimpy	170602040104; 170602040202	1.7	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Pratt Crk	170602040203; 170602040204	.75	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1qt/acre	June/ July 2002	none
Warm Sprgs Wood Rd.	170602040302; 170602040201; 170602040204	.62	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/acre	June/ July 2002	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Warm Sprgs to Kenny Crk	170602040302	3.8	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/acre	June/ July 2002	none
WarmSprgs Wood Rd.	170602040302; 170602040303	3.4	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/acre	June/ July 2002	none
Kenny Crk Spur Rd.	170602040302; 170602040201	.31	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/acre	June/ July 2002	none
Geertson Crk	170602040103	.94	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/acre	June/ July 2002	none
TOTAL ACRES		43.97	0.85						

Mid Salmon-Panther Subbasin 17060203

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species &Life Stages Potentially Affected
McKim Creek, River bench	170602031204; 170602031201	.31	0	ATV sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Kilpatrick Cabin	170602031201	4.8	0	ATV sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Kilpatrick Cabin	170602031201	1.2	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Kilpatrick Rec	170602031201	1.6	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Ringle Crk Hwy 93	170602031201	.10	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	April 2002	none
Iron Creek	170602031401	.40	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	2 qts/ acre	April 2002	none
Iron Crk, Hwy 93	170602031201; 170602031101	.06	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	April 2002	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species &Life Stages Potentially Affected
Warm Springs Crk; Goldbug Ridge	170602031101; 170602031202	.16	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Birch Crk. Timber Sale; Salmon R.	170602031101	.63	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
11 Mile Rec. Site	170602031001	.05	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1.5oz/ 1.5 gal	May 2002	none
Williams Lake water tank	170602031103	.50	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Williams Lake Campground	170602031103	4.7	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
William Lake exclosure	170602031103	0	.003	backpack	Rodeo & 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species &Life Stages Potentially Affected
Hot Sprgs Allot.	170602031002; 170602031003	6.9	.10	ATV/ backpack	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	April 2002	none
Spring Crk Russian knapweed	170602030902; 170602031003	.9	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
8Mile Rec Site	170602031001	.37	.13	ATV/ backpack	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing, migration CH - migration BT - rearing, migration
Shoup Bridge Rec Site	170602031001	0	.33	backpack sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	May 2002	SH - rearing, migration CH - migration BT - rearing, migration
Edwards River Spurge	170602031003	0	.80	backpack	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	7-12-02	SH - rearing, migration CH - migration BT - rearing, migration

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species &Life Stages Potentially Affected
Sunset Hts Burn, Hot Springs Allot.	170602031001	3.0	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
River Bluff Rd	170602030901	.44	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1qt/ acre	June /July 2002	none
West of Fairgrounds	170602030901	.10	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Diamond Moose	170602030901	.25	.01	ATV/ backpack	Rodeo & 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	May-June 2002	none
South of Diamond Crk	170602030901	.30	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 quart/ acre	May-June 2002	none
Morgan Bar	170602030701	0	1.6	ATV	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing, migration CH - migration BT - rearing, migration

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species &Life Stages Potentially Affected
Hot Sprgs Island	170602030701	.38	.05	ATV	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing, migration CH - migration BT - rearing, migration
Tower Crk Hwy 93	170602030701	.02	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	April 2002	none
Tower Creek Rec.	170602030701	0	.06	backpack	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing, migration CH - migration BT - rearing, migration
Tower Crk Island	170602030701	0	.20	backpack	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing, migration CH - migration BT - rearing, migration
Badger Sprg Gulch	170602030701	1.8	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Tower- Red Rock Salmon Corridor	170602030501	.34	0	backpack	2,4-D	2,4-D	1 qt/ acre	6-29-02	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species &Life Stages Potentially Affected
Carmen Crk to Forest Boundary	170602030801	1.3	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Beer Can Flats	170602030802	1.1	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Badger Springs	170602030701; 170602030801	.85	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Freeman Crk	170602030802	.34	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Tower Crk North	170602030501	1.60	0	horse/ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Tower Crk	170602030501	.12	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Tower Crk Dumpster	170602030501	.20	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species &Life Stages Potentially Affected
Tower Crk	170602030501	.31	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ July 2002	none
Tower Creek Rec Site	170602030501; 170602030701; 170602030702	0	.25	backpack	Rodeo & 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing, migration CH - migration BT - rearing, migration
McDaniel Spring (Salmon R.)	170602031205	1.5	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ August 2002	none
McDaniel Pump Access (Salmon R.)	170602031205	0	.5	Backpack sprayer	Rodeo & 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	May/ June 2002	SH - rearing, migration CH/SO - migration BT - rearing, migration
Deer Gulch Rec. Site Access Road (Salmon R.)	170602031205	1.0	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	May/ June 2002	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species &Life Stages Potentially Affected
Allison Creek (Salmon R.)	170602031204	1.5	.5	Backpack sprayer	Rodeo & 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ August 2002	SH - rearing BT - rearing, migration
Pig Creek (L.Hat)	170602031302	7.0	0	ATV/ Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	July/ Sept-ember 2002	None
Deer Gulch (Mo. @ Salmon River)	170602031205	0	5.0	Backpack sprayer	Rodeo & 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing, migration CH/SO - migration BT - rearing, migration
Salmon River (Near Syd Dowton Place)	170602031201	0	5.0	Backpack sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ July 2002	SH - rearing, migration CH/SO - migration BT - rearing, migration
TOTAL ACRES		46.47	17.033						

Pahsimeroi River subbasin 17060202

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Morse Creek (upper and lower)	170602020202	2.0	2.0	Backpack sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/July 2002	BT - rearing
Little Morgan Creek (Pah. R.)	170602020102	2.0	14.0	Backpack sprayer ATV sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	July/ August 2002	BT - rearing
Falls Creek (Pah)	170602020203	10.0	1	ATV	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ September 2002	BT - rearing
Pahsimeroi Gravel Pit	170602020203	1.0	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	None
Patterson Mine Site (Pah. R.)	170602020302	.56	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	none
Trail Creek (Pahsimeroi)	170602020104	2.0	4.75	Backpack sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ August 2002	No listed fish
Big Creek (Pah R.)	170602020401	.33	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	none
Goldburg Cut Across Road	170602020502	1.8	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	None
Robbins Fenceline above Pah. River	170602020201	.34	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	None
Grouse Creek (Pah. R.)	170602020201	1.3	0	ATV/ backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	None
TOTAL ACRES		21.33	21.75						

Upper Salmon Subbasin 17060201

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Cottonwood Rec. Site (Salmon R.)	170602010101	0	8.8	Backpack sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	May/June 2002	SH - rearing, migration CH/SO - migration BT - rearing, migration
West Fk Morgan Creek (Morgan Cr.)	170602013203	60	0	ATV sprayer/ Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	July/ August 2002	none
First Crossing Rec. Site (Morgan Cr)	170602013201	3.0	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	none
Second Spring (Darling Creek)	170602013003	1.5	.5	Backpack sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/ August 2002	No listed species
East Fork Rec. Site	170602011201	2.5	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	none
Lake Creek Road (East Fork)	170602010802	7.1	0	ATV	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ August 2002	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Herd Lake Overlook/ Lower Rec. Site (East Fork)	170602010802	2.9	0	ATV Backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ August 2002	none
Blue Creek (Morgan Cr)	170602013201	4.8	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ August 2002	None
Kinnikinic Creek Access Road (Salmon R.)	170602011203	1.0	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1qt/ acre	June/July 2002	None
Clayton Bridge River Access (Salmon R.)	170602011203	0	1.0	Backpack sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/July 2002	SH - rearing, migration CH/SO - migration BT - rearing, migration
Thompson Creek Mine Access Road (Salmon R.)	170602011305	.5	0	Backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1.5oz/ 1.5 gal	May/June 2002	none
Malm Gulch (Salmon R.)	170602010402	7.5	0	ATV/ Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/ August 2002	None
Syd Dowton Exchange (Salmon R.)	170602010101	2.5	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	May/June 2002	none

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Mike Springs Access Road (Salmon R.)	170602010101	2.0	0	Backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	None
Saturday Mtn.(Squaw Cr)	170602012801	.5	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 quart/ acre	June/July 2002	None
Beardsley Gulch (Bayhorse Cr.)	170602010405	.75	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	July/ September 2002	None
Daugherty Gulch (Challis Cr)	170602012901	10	0	ATV/ Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4_D	1 qt/ acre	May/June 2002	None
River View Mine Access Road (Bayhorse Cr.)	170602010405; 170602010404	1.0	.80	backpack	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June 2002	SH - rearing, migration BT - rearing, migration
Spud Creek (East Fork)	170602011201	.5	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	None
L&W Stone Quarry (Salmon R.)	170602010404; 170602010501;	1.0	0	Backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	June/July 2002	None

Drainage Name/code and Description	6th Level HUC	Upland Acres Treated	Riparian Acres Treated	Application Method	Product Name	Active Ingredient (AI)	Application Rate (lbs. AI/Ac.)	Timing	Species & Life Stages Potentially Affected
Centennial Flat (Salmon R.)	170602010404	.5	0	backpack	Tordon/ 2,4-D	Picloram/ 2,4-D	1 quart/ acre	June/ August 2002	None
Bayhorse Rec. Site (Salmon R.)	170602010401	.33	.05	Backpack sprayer	Rodeo &/or 2,4-D formulas	Glyphosate & 2,4-D	1-1.5#/ acre	June/July 2002	SH - rearing, migration CH - migration BT - rearing, migration
Wood Creek (Bayhorse Cr.)	170602010401	5.0	0	Backpack sprayer	Tordon/ 2,4-D	Picloram/ 2,4-D	1 qt/ acre	July/ August 2002	None
TOTAL ACRES		114.88	11.15						

APPENDIX B

Description of Herbicide Properties

Clopyralid - is 3,6-dichloro-2-pyridinecarboxylic acid, an auxin growth regulator that acts as a synthetic auxin or hormone, altering a plant's metabolism and growth characteristics. Clopyralid is in the pyridine carboxylic acid family which includes herbicides such as picloram. The formulation of Transline® is manufactured by Dow Agro and contains 40.9% clopyralid as the monoethanolamine salt and 59.1% inert ingredients. The inert ingredients in Transline® are water, isopropyl alcohol and a proprietary surfactant (Information Ventures 1995b).

Clopyralid does not bind tightly to soil and thus would seem to have a high potential for leaching. However, the potential of clopyralid to be transported to streams via groundwater is minimal due to the rapid degradation in the soil which prevents leaching (Information Ventures 1995b). Half life is between 15 to 287 days with soil microbes being responsible for a major portion of the degradation. Anaerobic soils have lower decomposition rates due to lower populations of microbes.

Clopyralid also has a low level of toxic risk to aquatic species based on field studies. At application rates of 1 pound per acre, the observed contamination in water was about 50 times lower than the lowest LC50 for aquatic animals (.0021 mg active ingredient per liter). For fish, only 96 hour toxicity bioassays are available with the lowest reported LC50 for clopyralid being 103 mg a.i./L. Macro-invertebrates may be less sensitive with LC50s of 232 mg a.i./L (Ahrens 1994). Toxic effects on *Daphnia* are reported in Syracuse Environmental Research Associates, Inc. (SERA 1999), which has an LC50 of 350 mg acid equivalents (a.e.) per liter, for the monoamine salt. If other invertebrates respond similarly to daphnia, lethal effects on aquatic invertebrates are unlikely. The effects of clopyralid seem to be the greatest on aquatic plants. The EC50 for growth inhibition in duckweed was measured at 89 mg/L (SERA 1999). At lower concentrations growth of other aquatic macrophytes is stimulated (Forsyth et al 1997). The lowest reported EC50 for growth inhibition of green algae is 6.9 mg/L (Ahrens 1994). It appears that there could be potential losses in primary productivity from algae killed by clopyralid, based on an EC50 for algae of 6.9 mg/l; however, concentrations lethal to algae are unlikely to occur unless clopyralid is directly added to water, or if rainfall washes the chemical into a stream shortly after it is applied.

2,4-D - is 2,4-Dichlorophenoxyacetic acid, a chlorinated phenoxy chemical that interferes with normal plant growth processes by stimulating nucleic acid, protein synthesis and affecting enzyme activity, respiration, and cell division. Uptake of the compound occurs through leaves, stems, and roots (Information Ventures 1995a). 2,4-D is used to control many types of broadleaf weeds and is toxic to most broad leaf crops, especially cotton, tomatoes, beets, and fruit trees. The registered use rate is 0.475 to 3.8 pounds a.i./acre, and the method of application may be aerial and ground spraying, lawn spreaders, cut surface treatments, foliar spray, basal bark spray, or injection (Extoxnet 1996a; Information Ventures 1995a).

There are many forms or derivatives of 2,4-D, however, only the amine salt is proposed for use by the BLM. Consequently, unless otherwise noted below, "2,4-D" refers only to the amine salt.

Commercially produced 2,4-D may contain one or more inert ingredients. Weedar 64 (liquid) contains 46.8% dimethylamine salt of 2,4-D and 53.2% inerts. Weedestroy contains 47.3% dimethylamine salt of 2,4-D and 52.7% inerts.

Little et al (1990) examined behavior of rainbow trout exposed for 96 hours to sublethal concentrations of 2,4-D amine, and observed inhibited spontaneous swimming activity and swimming stamina. Changes in schooling behavior and red blood cells, reduced growth, impaired ability to capture prey, and physiological stress were reported for 2,4-D (Gomez et al 1998; Cox 1999). 2,4-D can also combine with other pesticides and have a synergistic effect, resulting in increased toxicity. Combining 2,4-D with picloram damages cells of catfish (*Ictalurus spp.*) gills, although neither individual pesticide has been found to cause this damage (Cox 1999). Fry and fingerlings are considerably more sensitive than eggs to two amine salts of 2,4-D. In fathead minnows, tests with the dimethyl amine of 2,4-D yielded 96 hour LC50s ranging from 320-6300mg/l for fingerlings and swim-up fry, compared with over 1,400 mg/l for the egg stage. In rainbow trout, tests with dodecyl/tetradodecyl amine against several life stages yielded LC50s (mg/l) of 3.2 for fingerlings, 1.4 for swim-up fry, 7.7 for yolk-sac fry, and 47 for eggs (Johnson and Finley 1980). Sublethal effects for the amine salt form include the reduction in the ability of rainbow trout to capture food at 5 ppm. Research has shown bioconcentration in fish tissue. (Cox 1999; Toxnet 2002a; Walters 1999).

The SERA (1998b) report suggests that amine formulations have relatively low toxicity to aquatic invertebrates and aquatic plants, although the effects are highly variable. Acute toxicity tests exposing the cladoceran, *Simocephalus vetulus*, to the sodium salt of 2,4-D show complete mortality following 96 hours of exposure to concentrations ranging from 0.5 to 5.0 mg. USEPA (1989) reported for the dimethylamine salt, a LC50 for grass shrimp of 0.2 mg/L. SERA (1998b) concluded that some species of aquatic algae are sensitive to concentrations of approximately 1 mg/L 2,4-D, however, low levels of the compound may stimulate algal growth in some species. Ester formulations have much greater toxicity, but are not proposed for use by the BLM.

Sublethal effects for the amine salt form include the reduction in the ability of rainbow trout to capture food at 5 mg/l (Cox 1999). Sublethal effects studies showed that the growth of juvenile chinook salmon was reduced with a concentration of 0.6 ppm of the butoxyethanol ester formulation. Using the same formulation, physiological stress responses in sockeye salmon (*Oncorhynchus nerka*) occurred at 0.3 ppm (Toxnet 2002a). One experimental model studied acute lesions in the area of the kidney that produces red blood cells in tench (*Tinca tinca*) caused by continuous exposure to 2,4-D acid dissolved in water at 400 mg/l. Fifty fish were used; 15 for calculating the LC50 and 35 were euthanized in five treated and two control groups. Tissue samples revealed marked alteration of red blood cells, characterized by progressive swelling and tissue death, and activation of white blood cells. The lethal dose (LC50) at 96 hours demonstrated the importance of the species and chemical form used as factors in calculating a product's toxicity (Gomez et al 1998).

A relationship exists between toxicity and pH level in a waterbody. In one study, the percent of fathead minnows surviving a particular concentration of 2,4-D increased as the pH increased in the water. At a concentration of 7.43 mg/l, 60% of the fish survived in 192 hours at pH 7.6, whereas 100% survived at pH 9.8. At the former concentration, normal schooling behavior was completely disrupted and equilibrium lost after 24 hour exposure. At the latter concentration, neither effect was noted, with pH measured at 8.68 and 9.08. A relationship between pH and the degradation of 2,4-D is present in soil medium as well (Toxnet 2002a).

Toxicity of 2,4-D varies with pH. The amine form of 2,4-D is nearly four times more toxic to fathead minnows at high pH levels (8.5), while the acid and ester forms are about half as toxic to fish at this pH level (Johnson and Finley 1980). Due to the presence of limestone, high pH values are likely to occur in the Pahsimeroi River drainage and in the headwaters of the East Fork Salmon River drainage; consequently, listed fish may be more susceptible to mortality from 2,4-D in these drainages.

The fate of 2,4-D may also be affected by several processes including runoff, adsorption, chemical and microbial degradation, photodecomposition, and leaching. In general, 2,4-D has a moderate persistence in soil with a field dissipation half-life of 59.3 days, aerobic half-life of 66 days, and a hydrolysis half-life of 39 days. For some chemicals, such as 2,4-D, the influence of soil pH is mainly responsible for transformation from anionic[4] to nonionic[5] forms with decreasing pH. This can, in turn, affect adsorption. At less than a pH level of 6.0, 2,4-D is in nonionic form. Increasing the pH above 6.0 turns 2,4-D anionic. In slightly acidic soils, 2,4-D will be adsorbed at a pH level of less than 6.0 but will not be readily adsorbed at a pH level of 7.0 if in the anionic form, because the negative charges of the soil and of the chemical, repel each other (Walters 1999; Welp and Brummer 1999).

Overall, the persistence of 2,4-D depends upon formulation, pH, soil moisture, soil type, temperature, microbes, and the status of pre-exposure to 2,4-D or its salts or esters (which alters concentrations of 2,4-D applications in the soil). Once in soil, 2,4-D esters and salts are first converted to the parent acid prior to degradation (Walters 1999).

The rate of microbial degradation is dependent upon the water potential, depth and temperature of the soil. Han and New (1994) found that sandy loam soil containing 2,4-D degrading single-celled bacteria, filamentous bacteria (actinomycetes), and fungi had the lowest degradation rates at a low water potential, and an increase in water potential resulted in increased rates of breakdown. Dry soil conditions inhibit 2,4-D mineralization by restricting mobility, reducing the degrading activity of organisms, and suppressing the 2,4-D degrading microorganism populations. The rate of microbial degradation decreases with increased soil depths and lower temperatures (Walters 1999).

In coarse-grained sandy soils where both biodegradation and adsorption will be low, or with very basic soils, leaching to groundwater may occur (Toxnet 2002a). Because of the different formulations, 2,4-D ranges from being mobile to highly mobile in sand, silt, loam, clay loam, and sandy loam. Grover (1977) found that higher volumes of water were required to leach 2,4-D from soils with a high organic content. Leaching was correlated with the pH of soils, with 2,4-D leaching more readily in soils with pH's of 7.5 and above reflecting higher adsorption to organic matter in more acidic soils.

Despite its potential mobility, 2,4-D generally persists within the top few inches of the soil. Walters (1999) applied 2,4-D at the rate of 4.49 kg/ha in the ester form to nursery plots with varying crop covers. The 2,4-D remained in the top 20 cm of the soil.

Timing and intensity of rainfall are important factors in determining the movement and extent of 2,4-D leaching in soil. It was found that 2,4-D is susceptible to runoff if rain events occur shortly after application, with runoff concentrations decreasing over time (Walters 1999). Also, the amount of litter and debris on the soil surface will provide infiltration, as 2,4-D adsorbs to the surfaces of a litter and humus layer.

Norris (1981) states that entry into waterbodies via leaching is not a significant transport method for significant quantities of 2,4-D, since most of it is adsorbed onto organic material and later

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[4] Negatively charged ion

[5] No charge on the ion

readily degraded by microbial organisms. Despite assurances such as these, 2,4-D has been detected in groundwater supplies in at least five U.S. states and Canada, and very low concentrations have been detected in surface waters throughout the United States (Extoxnet 1996a).

Persistence of 2,4-D in water is dependent upon the formulation, volatilization, level of nutrients present, pH level, temperature, oxygen content, and whether or not the water has been previously contaminated with 2,4-D or other phenoxyacetic acids. Microbial degradation is a possible route for the breakdown of 2,4-D, but it is very dependent on the characteristics of the water. In the lab, studies have shown that in warm, nutrient rich water that has been previously treated with 2,4-D microbial degradation can be a major factor for dissipation. However, natural surface waters are generally cool with nutrient concentrations less than those needed to maintain 2,4-D degrading microorganism populations. These conditions would not promote the growth of microorganisms needed to achieve microbial degradation (Walters 1999). Microbial activity will play a important role in waters with bottom mud sediments and sludge. Degradation increases with sediment load (Extoxnet 1996a; Toxnet 2002a).

Picloram - is 4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid, or Tordon®, which is the product formulation proposed for use by the BLM. Picloram is registered by the Environmental Protection Agency (EPA) as a "Restricted Use" pesticide due to its high mobility in water and extreme toxicity to many important crop plants (Information Ventures 1995d). Picloram is formulated either as an acid (technical product), a potassium salt, a triisopropanolamine (TIPA) salt, or an isooctyl ester, and is available as either soluble concentrates, pellets, or granular formulations (Extoxnet 1996c; Spectrum Laboratories 2002). The active ingredient in Tordon is the TIPA salt. Consequently, "picloram," as it is used below, refers only to the TIPA salt of picloram, unless otherwise noted.

Picloram is used for control of woody plants and a wide range of broad-leaved weeds. Most grasses are resistant to picloram, so it can be used in range management programs to control bitterweed, knapweed, leafy spurge, locoweed, larkspur, mesquite, prickly pear, and snakeweed on rangeland in the western states.

Picloram is a pyridine carboxylic acid herbicide. It is absorbed by the plant roots, leaves and barks. It moves both up and down within the plant, and accumulates in new growth, interfering with the plant's ability to make proteins and nucleic acids (Information Ventures 1995d).

Tordon® contains 24.4% picloram, and 75.6% inert ingredients, which include water and dispersing agents, including surfactants (Information Ventures 1995d).

The parent acid is characterized as moderately toxic to freshwater fish, with a LC50 of 5.5 mg/l and slightly toxic to freshwater invertebrates (LC50 of 34.4 mg/l). The parent material has been tested on rainbow trout in various life stages, yielding a 96 hour LC50 of 8.0 mg/l for the yolk sac stage, 8.0 mg/l for the swim-up stage, and 11.0 mg/l for the fingerling stage (Extoxnet 1996c; USGS 2000a). Field runoff studies conducted with cutthroat trout conclude that concentrations as low as 290 ug/l and 610 ug/l of the parent acid will affect survival & growth of cutthroat trout (*Oncorhynchus clarkii*). The EPA characterizes picloram TIPA salt as slightly toxic to freshwater fish, with a LC50 of 25 mg/l. A test with coho salmon yielded a LC50 of 20 ppm (USEPA 1995). Other formulations are slightly to moderately toxic to fish or invertebrates (USEPA 1995). Fish early-life stage and Life-Cycle Aquatic Invertebrate Studies provided Lowest Observed Effect Concentrations (LOECs) of 0.88 mg/l and 18.1 mg/l, respectively (USEPA 1995). In a static tests of the toxicity of picloram acid to cutthroat and lake trout (*Salvelinus namaycush*), the 96 hour LC50s ranged from 25 to 86 mg/l for picloram (Woodward 1976). In a simulated field study, Mayes (1984) found that concentrations greater than 13 mg/l following rainfall increased fry mortality in cutthroat trout and concentrations greater than 0.61 mg/l decreased growth. No adverse affect was noted from less than 0.29 mg/l (Woodward 1976).

The toxicity of picloram potassium salt to aquatic organisms was evaluated in static acute toxicity tests. Species tested were the fathead minnow, rainbow trout, bluegill, and the daphnia (*Daphnia magna*). Rainbow trout was the most sensitive species tested with LC50 96 hour median lethal concentrations of 48 mg/l. This LC50 value is 36-fold greater than picloram concentrations detected in freshwater following application to experimental watersheds (Toxnet 2002c).

Woodward (1976), in a study of lake trout, found that picloram reduced fry survival, weight, and length at concentrations of 0.04 mg/l, and that the rate of yolk sac absorption and growth of lake trout fry was reduced in flow-through tests at concentrations as low as 0.35 mg/l. His research also indicated that chronic toxicity on early life stages of lake trout is more significant than might be anticipated on the basis of only acute tests with fingerlings (Woodward 1976). Tests with the early life-stages of rainbow trout showed that picloram concentrations of 0.9 mg/L reduced the length and weight of rainbow trout larvae, and concentrations of 2 mg/L reduced survival of the larval fish (Mayes et al 1987). Yearling coho salmon exposed to 5 mg/L of picloram for 6 days suffered "extensive degenerative changes" in the liver and wrinkling of cells in the gills (USEPA 1979). Coho salmon smolts exposed to Tordon 101 (mixture that contains picloram and 2,4-D) at 0.6 to 1.8 mg/L for 96 hours prevented successful migration upon release (Ahrens 1994). Picloram is not expected to accumulate appreciably in aquatic organisms; the measured bioconcentration factor in bluegill sunfish was less than 0.54 (Extoxnet 1996c; Information Ventures 1995d).

Picloram was applied to control spotted knapweed on two sites in the Northern Rockies in a study to examine persistence, rainfall induced migration, potential contamination of surface and groundwater, and losses by photodegradation for 445 days. Two sites were selected to represent best case and worst case conditions for on site retention of picloram. A valley bottom was treated with 0.28 kg/ha in the spring of 1985 and sampled over 445 days. In the spring of 1986, picloram was applied to both sides of a minimal construction logging road extending 4 km along a stream draining a granitic upper mountain watershed. Of the 17.1 sq km watershed, 0.15% was sprayed. Vegetation, soils, surface water, and groundwater near the road were sampled during the 90 days following application. After 90 days, 78% of the picloram remained in the mountain watershed. It was not detected in the surface water or the groundwater during the 90 days after application. At the valley bottom site, 36, 13, and 10.5% of the picloram persisted after 90, 365, and 445 days. It was concluded that loss by photodegradation was an important factor at both sites during the first 7 days (Toxnet 2002c).

Environmental fate data indicate that picloram is mobile and persistent in laboratory and field studies (USEPA 1995). Picloram is classified as moderately to highly persistent in the soil environment, with field half-lives generally from 20 to 300 days. However, some experiments show persistence exceeding 5 years. The estimated average is 90 days. Photodegradation is significant only on the soil surface and volatilization is insignificant. Degradation by microorganisms is mainly aerobic, and dependent upon application rates. Increasing soil organic matter increases the sorption of picloram and increases the soil residence time. Picloram adsorbs to clay and organic matter and is highly soluble in water. Picloram is poorly bound to soils lacking clay or organic matter, and can be leached out of the soil. These properties, combined with its persistence, mean it may pose a risk of groundwater contamination. Picloram has been detected in the groundwater of 11 states at concentrations ranging from 0.01 ug/l to 49 ug/l (Extoxnet 1996c; Information Ventures 1995d).

Picloram can be carried by surface run-off water, since it is water soluble. If released to water, will not appreciably adsorb to sediments, and will not evaporate, or readily hydrolyze. It is subject to photolysis[6] if it is near the water's surface, with reported half-lives ranging from 2.3 to 41.3 days. In laboratory studies, sunlight readily broke down picloram in water, with a half-life of 2.6 days. In the field, herbicide levels in farm ponds were 1 mg/l following spraying and decreased to 0.01 mg/l within 100 days, primarily due to dilution and sunlight (Extoxnet 1996c; Toxnet 2002c).

Glyphosate - or N-(phosphonomethyl) glycine. Glyphosate is available in a variety of commercial formulations, but Rodeo is the only glyphosate formulation proposed for use by the BLM. Consequently, the effects analysis below refers only to Rodeo, unless otherwise noted. Rodeo contains 41.5% glyphosate (isopropylamine salt) and 58.5% water. It may be used in formulations with other herbicides (Extoxnet 1996b). Glyphosate is a broad-spectrum, nonselective systemic herbicide used to control grasses, herbaceous plants including deep rooted perennial weeds, brush, some broadleaf trees and shrubs, and some conifers. The registered use rate is 0.3 to 4.0 pounds of a.i/ac and may be applied by aerial spraying; spraying from a truck, backpack or hand-held sprayer; wipe application; frill treatment; or cut stump treatment. It is absorbed by leaves, moves rapidly through the plant, acting to prevent production of an essential amino acid that inhibits plant growth. In some plants, glyphosate is metabolized or broken down while other plants do not break it down (Extoxnet 1996b; Information Ventures 1995c).

Glyphosate is highly toxic to all types of terrestrial plants and is used to kill floating and emergent aquatic vegetation. Glyphosate does not appear to have similar toxicity to algae. Glyphosate acid and its salts are classified as "moderately toxic" compounds by the EPA. Technical glyphosate acid (parent compound) is "practically nontoxic" to fish and may be "slightly toxic" to aquatic invertebrates. The 96 hour LC50 is 86-140 mg/l in rainbow trout and 120 mg/l in bluegill sunfish. The 48 hour LC50 for glyphosate in daphnia (water flea), an important food source for freshwater fish, is 780 mg/l. The results of a rainbow trout yolk-sac 96 hour LC50 static bioassay yielded results at the 3.4 mg/l level (USGS 2000b). Glyphosate and its formulations have been tested for chronic effects in aquatic animals, and neurologic, immunologic, and endocrine function does not appear to be affected (Durkin and Diamond 2002).

There is a very low potential for the compound to build up in the tissues of aquatic invertebrates or other aquatic organisms (Extoxnet 1996b). In one study of bioaccumulation and persistence, glyphosate was applied to two hardwood communities in Oregon coastal forest and none of the 10 coho salmon fingerlings analyzed had detectable levels of the herbicide or its metabolite aminomethylphosphonic acid, although levels were detectable in stream water for three days and in sediment throughout the 55 day monitoring period (Toxnet 2002b). Information on sublethal effects of glyphosate is available for many of the above endpoints, and of those reported, glyphosate appears to carry a low risk for sublethal effects. Simenstad et al (1996) found no significant differences between benthic communities of algae and invertebrates on untreated

[6] chemical decomposition by the action of radiant energy

mudflats and mudflats treated with Rodeo. It appears that under most conditions, rapid dissipation from aquatic environments of even the most toxic glyphosate formulations prevents build-up of herbicide concentrations that would be lethal to most aquatic species.

In the aquatic environment with freshwater fish, toxicity appears to increase with increasing temperature and pH. As reported in the Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates (Johnson and Finley 1980), glyphosate was twice as toxic to rainbow trout at 17°C than at 7°C. With bluegills, toxicity was twice as toxic at 27°C compared to 17°C. Toxicity was also 2 to 4 times greater to bluegills and rainbow trout at a pH level of 7.5 to 9.5 than at pH 6.5 (PH of 7.0 is considered "neutral water").

Glyphosate is moderately persistent in soil, with an estimated average half-life of 47 days. Field half-lives range from 1 to 174 days. It is strongly adsorbed to most soil types, including types with low organic and clay content. Therefore, even though it is also highly soluble in water, it has a low potential for runoff (except as adsorbed to colloidal matter) and leaching. One study estimated that two percent of the applied chemical was lost to runoff. Microbes appear to be the primary pathway for degradation of glyphosate (biodegradation), while volatilization or photodegradation (photolysis) losses are negligible (Extoxnet 1996b). Under laboratory conditions, glyphosate has been rapidly and completely biodegraded by soil microorganisms under both aerobic and anaerobic conditions.

Although glyphosate has a low propensity for leaching, it can enter waterbodies by other means, such as overspray, drift, erosion of contaminated soil. Once in water, glyphosate is strongly adsorbed to any suspended organic or mineral matter and is then broken down primarily by microbes. Sediment adsorption and/or biodegradation represents the major dissipation process in aquatic systems. Half-lives in pond water range from 12 days to 10 weeks (Extoxnet 1996b).

Evidence from studies suggest that glyphosate levels first rise and then fall to a very low, or even undetectable level, in aquatic systems. After glyphosate was sprayed over two streams in rainy British Columbia, levels in the streams rose dramatically after the first rain event, 27 hour post-application, and fell to undetectable levels 96 hours post-application. The highest glyphosate residues were found in sediments, indicating strong adsorption characteristics of this herbicide. Residues persisted for the entire 171 day monitoring period. It was found that suspended sediment is not a major mechanism for glyphosate transport in rivers (Toxnet 2002b).

Questions have been raised about the role photodegradation plays once glyphosate is in a waterbody, particularly when laboratory versus field conditions are involved. The EPA states in the Registration Eligibility Document (USEPA 1993) that glyphosate is stable to photodegradation in pH 5, 7, and 9 buffered solutions under natural sunlight.

Sulfometuron-methyl - is methyl 2-[[[[(4,6-dimethyl-2-pyrimidinyl) amino] caronyl] amino] sulfony] benzoate. Oust is the formulation proposed for use by the BLM. Oust contains 75% sulfometuron-methyl and 25% inert ingredients. None of the inert ingredients have currently been released to the EPA. High pH soils increase the persistence of the chemical. Breakdown occurs only through biodegradation in high pH soils, whereas soils with lower pH allow for both chemical degradation and biodegradation to occur (Ross and Childs 1996). Oust is used for the control of annual and perennial grasses and broad leaved weeds in non-crop lands. It is also used to control woody tree species in many forested areas. Oust is typically applied either post-or pre emergent and works by blocking cell division in the active growing regions of stems and root tips (meristematic tissues) (Information Ventures 1995e). The registered use rate is up to 8.0 ounces of active ingredient per acre (Information Ventures 1995e). Oust can be applied as a stand along herbicide; however, most applications are in combination with other herbicides such as diuron, glyphosate, or hexazinone (SERA 1998a).

The lowest reported concentrations of sulfometuron methyl at which mortality was observed in either bluegill sunfish or flathead minnow was 1.25 mg/L (SERA 1998a). Mortality of one bluegill sunfish out of 10 was reported at this level, however, during the same study using 12.5 mg/L, no mortality occurred among 10 bluegill sunfish (SERA 1998a). Based on a chronic daphnid study, the longer term reproductive NOEL (no observable effect level) is approximately 100 mg a.i./L. SERA (1998a) reported that sulfometuron-methyl had no effect on hatchability, growth, or survival of flathead minnow eggs or fry, at concentrations of 1.17 mg a.i. per liter (L). Potential chronic effects of sulfometuron methyl at concentrations between 1.17 mg a.i./L and 100 mg a.i./L cannot be dismissed, but long-term exposure to greater than 1 mg a.i./L sulfometuron methyl is unlikely (SERA 1998a). Toxicological tests using salmonids are not available, consequently, potential lethal and sublethal effects of Oust on listed salmon and steelhead are unknown.

Sulfometuron-methyl appears to be relatively non-toxic to aquatic invertebrates. The LC50 values reported in SERA (1998a) for daphnids, crayfish, and field-collected species of other aquatic invertebrates are all above 802 mg/L, some by more than a factor of 10. No daphnid mortality was reported for groups exposed to concentrations of up to 12.5 mg/L. One daphnid reproduction study noted a reduction in the number of neonates at 24 mg/L, but not at 97 mg/L or at any of the lower concentrations tested. Aquatic plants are far more sensitive than aquatic invertebrates, although there appears to be substantial differences in sensitivity among species of macrophytes and unicellular algae. There are no published or unpublished data known regarding the toxicity of sulfometuron methyl to aquatic bacteria or fungi. By analogy to the effects on terrestrial bacteria and aquatic algae, it seems plausible that aquatic bacteria and fungi will be sensitive to the effects of sulfometuron methyl. Primary production is likely to be reduced in places where sulfometuron-methyl reaches water. The SERA (1998a) reported water concentrations, after a rainfall, 1 to 2 orders of magnitude higher than the EC50 concentrations for some algal. The EC50 concentration for the freshwater algae *Senenstrum capriconutum* was 0.0046 mg a.i./L in a 120 hour EC50 based on a reduction in cell density relative to controls (SERA 1998b). The EC50 values for other freshwater algal species are generally greater than 0.01 mg/L, depending on the endpoint assayed (Landstein et al 1993), but still fall in a range of concentrations that are likely to occur after a rainfall.

At least one percent of the applied sulfometuron methyl applied to an area could run off from the application site to adjoining areas after a moderate rain, based on studies of runoff from 84 mm of total rainfall (43 mm/hour for 2 hours) by Hubbard et al (1989) and from 12 to 30 mm of rain rainfall by Wauchope et al (1990). In the case of a heavy rain, losses could be much greater and might approach 50% in cases of extremely heavy rain and a steep soil slope (SERA 1998a). Sulfometuron-methyl has a half-life of 1 month or less in anaerobic freshwater environments, and four months in sterile soils (SERA 1998a). Application rates of 5.76 ounces of a.i/ac resulted in concentrations of 0.02 (0.005-0.04) mg/L occurring in the ambient water immediately after a major rainfall (SERA 1998a). When adjusted for application rates of 1.6 ounces acid equivalent (a.e.) per acre (0.1 lb a.e./acre) the expected levels of sulfometuron methyl in ambient water would be 0.005 (0.001 - 0.01) mg/L, which is 100 times lower than the concentration where mortality of bluegill sunfish or flathead minnows was reported.